

A Strategic Decision-Making Model for Supply Chain

– A Void to be Filled

Jenny K Andersson
Therese Wemner

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Department of Business Administration
School of Economics and Management, Lund University
Box 7080
SE-220 07 Lund
Sweden

Department of Industrial Management and Logistics
Faculty of Engineering, Lund University
Box 118
SE-221 00 Lund
Sweden

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Abstract

- Title:** A Strategic Decision-Making Model for Supply Chain – A Void to be Filled
- Authors:** Jenny K Andersson
Therese Wemner
- Tutors:** Johan Lundin, Department of Industrial Management and Logistics
Carl-Henric Nilsson, Department of Business and Administration
- Sponsor:** Lars Jarmander, Director of Logistics Innovation, Sony Ericsson
- Core issue:** Many researchers emphasize the increasing strategic importance of supply chain management, but there is still a lack of concrete guidance for managers faced with strategic decisions in supply chain. Within decision-making theories, the rational decision-making model is the most commonly used. This because of its suitable foundation, enabling a structure to the complex decision process. The rational decision-making model is today not developed to include the aspects of strategic decision-making made in supply chain.
- Purpose:** The purpose of this thesis is to adjust a structured rational decision-making model, making it applicable for strategic decision-making in supply chain. An underlying objective is to test the model on a case at Sony Ericsson.
- Method:** A deductive approach has been used in this thesis and a single case study has been conducted. A qualitative method was used and both qualitative and quantitative data was compiled from literature studies, and interviews and documentation at the case company.
- Conclusions:** A strategic decision-making model for supply chain has been created, and thereafter tested on a case at Sony Ericsson. After testing the model we conclude that the rational decision-making model, used as a foundation in our model, contains appropriate steps for decision-making. However, more flexibility is needed in the sequences of the steps to accommodate for an ever-changing and complex business environment. The theoretical content that has been added to our model can be seen as a first step in theory-building in strategic decision-making in supply chain.
- Keywords:** Strategic decision-making, Supply chain management, Decision-making model, The Decisive Model, Sony Ericsson

A Strategic Decision-Making Model for Supply Chain – A Void to be Filled

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A Strategic Decision-Making Model for Supply Chain – A Void to be Filled

Table of Content

1	INTRODUCTION	9
1.1	BACKGROUND	9
1.2	CORE ISSUE	9
1.3	PURPOSE.....	10
1.4	FOCUS	10
1.5	OUTLINE OF THE THESIS	10
2	METHODOLOGY	12
2.1	OVERALL WORK PROCESS	12
2.1.1	<i>Case Study</i>	13
2.1.2	<i>Analyzing the Decision Model</i>	13
2.2	DATA COLLECTION	14
2.3	THE CHARACTER OF THE DATA.....	14
2.3.1	<i>Primary Sources</i>	15
2.3.2	<i>Secondary Sources</i>	16
2.4	RELIABILITY AND VALIDITY	16
3	THEORETICAL FRAMEWORK	17
3.1	DECISION-MAKING.....	17
3.2	STRATEGY	19
3.2.1	<i>Strategic Decision-Making</i>	21
3.3	SUPPLY CHAIN MANAGEMENT.....	21
3.3.1	<i>Strategic Supply Chain Management</i>	23
3.3.2	<i>Decision-Making in Supply Chain</i>	25
4	STRATEGIC DECISION-MAKING IN SUPPLY CHAIN	26
4.1.1	<i>Summary of the Key Findings from the Theories</i>	26
4.1.2	<i>Constructing a Strategic Decision-Making Model for Supply Chain</i>	27
4.1.3	<i>The Decisive Model</i>	29
5	SONY ERICSSON AND THEIR SUPPLY CHAIN	31
5.1	SONY ERICSSON	31
5.1.1	<i>Centralized Procurement and Logistics</i>	31
5.1.2	<i>The Operations within Centralized Procurement and Logistics</i>	32
6	THE CASE AT SONY ERICSSON	34
6.1	STEP 1: DEFINE THE PROBLEM	34
6.2	STEP 2: IDENTIFY CONCERNED SUPPLY CHAIN MEMBERS	35
6.2.1	<i>Supply Chain Members Affected by the Decision</i>	35
6.2.2	<i>Key People to Consult</i>	35
6.3	STEP 3: IDENTIFY THE DECISION CRITERIA	37
6.4	STEP 4: DEVELOP THE ALTERNATIVES	39
6.4.1	<i>Alternative 1 – Increased Capacity in Hong Kong</i>	39
6.4.2	<i>Alternative 2 – Parallel Hub in Beijing</i>	40
6.5	STEP 5: EVALUATE THE ALTERNATIVES.....	41
6.5.1	<i>External Analysis of the Supply Chain</i>	41
6.5.2	<i>Internal Analysis of the Supply Chain</i>	46

A Strategic Decision-Making Model for Supply Chain – A Void to be Filled

6.5.3	Total Cost Analysis.....	50
6.6	STEP 6: SELECT THE BEST ALTERNATIVE.....	55
6.6.1	Alternative 1 – Increased Capacity in Hong Kong.....	55
6.6.2	Alternative 2 – Parallel Hub in Beijing.....	56
6.6.3	Making the Decision.....	56
7	DISCUSSION.....	57
7.1	THE RATIONAL DECISION-MAKING MODEL AS A FOUNDATION.....	57
7.2	THE CONTENT OF THE STRATEGIC DECISION-MAKING MODEL IN SUPPLY CHAIN..	58
7.3	ANALYZING THE DECISIVE MODEL ACCORDING TO WACKER’S FRAMEWORK	59
7.3.1	Uniqueness	59
7.3.2	Conservatism.....	59
7.3.3	Generalizability.....	60
8	CONCLUSIONS.....	61
8.1	GENERAL CONCLUSIONS	61
8.2	CREDIBILITY OF THE STUDY	62
8.3	RECOMMENDATIONS FOR FURTHER STUDY.....	62
9	REFERENCES	63
9.1	PUBLISHED SOURCES.....	63
9.2	VERBAL SOURCES	67
9.3	ELECTRONIC SOURCES	68

1 Introduction

This chapter will discuss the background and the underlying theoretical issue that this research deals with. Afterwards, the purpose of the study will be defined. Finally, we will describe our focus and an outline of the report is provided so that the reader will get an overview of the contents in each chapter.

1.1 Background

With increased globalization many international organizations have given their organization a multinational dimension, either by outsourcing or by establishing affiliates in other countries. Globalization has also led to a shift in distribution, where products are manufactured in one part of the world and are sold in another. (Scholte, 2000) Thereby, supply chains has become more global in their geographical scope (Scharj and Skjøtt-Larsen, 2003). The global market is becoming more competitive, dynamic, and customer driven. Customers are demanding more variety, better quality and service, including both reliability and faster delivery. The resulting competitive environment requires low cost, high quality products in increasing varieties. (Duclos et al, 2003) Supply chain management is thereby increasingly important and a strategic priority for a firm (Schentzler, 2007; Vicery, 1999; Thuermer, 2005).

“As the economy changes, as competition becomes more global, it’s no longer company vs. company but supply chain vs. supply chain.” (Harold Sirkin, 2004)

With the growing global competition, supply chain management is facing more challenges, such as; lack of transportation and logistics infrastructure capacity, optimizing inventory performance, shorten delivery lead times, achieving lower manufacturing costs, trade regulations, and a more encompassing distribution. Hence, supply chain management is becoming increasingly complex, and strategic planning of the supply chain reaches a new level of difficulty. (La Londe, 2005; Krennek, 1997) At the same time as the globalization is making the external environment for the supply chain more complex, modern business management has undergone a paradigm shift where individual businesses no longer compete as solely autonomous entities but rather as supply chains (Lambert and Cooper, 2000). Thus, firms are more interdependent and co-operative relationships are becoming a competitive advantage (Bechtel and Jayaram, 1997; Vicery et al, 1999). Internal no longer refers to within the organization, but rather within the supply chain. When both the external and internal scope has broadened, factoring in all aspects makes strategic decision-making in supply chain more complex and difficult to comprehend.

1.2 Core Issue

When supply chain management becomes a competitive advantage (Vicery, 1999), strategic decisions within the supply chain gain more significance. At the same time decision-making in supply chain is harder for the managers to comprehend, when

having to take in account the growing global competition (Duclos et al, 2003) and the enlarged scope of internal influences (Bechtel and Jayaram, 1997).

Many researchers emphasize the increasing strategic importance of supply chain management, but there is still a lack of concrete guidance for managers faced with strategic decisions in supply chain. Harrison states that broadly speaking, strategic decisions are those which are important to an organization and consequences of unsuccessful strategic choices can work against the long-term health of an organization (Harrison, 1995).

A strategic decision can be signified by its complexity and that they require a good deal of study and analysis if they are to be understood and improved in organizations (Harrison, 1995). Within decision-making theories, the rational decision-making model is the most commonly used (Hatch, 2002). This because of its suitable foundation, enabling a structure to the complex decision process. The rational decision-making model helps the decision-maker to logically categorize all the information that needs to be considered when taking a decision. (Bakka et al, 1994)

When making decisions in supply chain it is important to focus beyond the firm's boundaries to include the impact of and on other supply chain members (Stank et al, 2005). The rational decision-making model is today not developed to include the aspects of strategic decision-making made in supply chain. Therefore, this thesis can be seen as an attempt to begin to fill this void.

1.3 Purpose

The purpose of this thesis is to adjust a structured rational decision-making model, making it applicable for strategic decision-making in supply chain. An underlying objective is to test the model on a case at Sony Ericsson.

1.4 Focus

Focus in this thesis is strategic decision-making in supply chain, and we will use Stevens' (1990) definition of what strategic supply chain management concerns: *“Strategic supply chain management should focus on developing; objectives and policies for the supply chain, the shape of the supply chain in terms of facilities and locations, and the outline of the organizational structure so that it supports and integrates the supply chain effectively.”* (Stevens, 1990)

1.5 Outline of the Thesis

Here we will provide the reader with a brief description of the disposition of this thesis. After the introduction made in this chapter, explaining the background and core issue of the study, the methodology of the thesis is described in chapter 2. Further, chapter 3 presents the theoretical framework from which we have developed our model, The Decisive Model. The basic theories used and described are decision-

making, strategy and supply chain management. In chapter 4, the key findings from each theory are presented and how they contribute to the constitution of the model. The chapter ends with a presentation of The Decisive Model. Chapter 5 is a brief introduction of the case company, Sony Ericsson and their supply chain, providing the reader with information necessary to understand the case at which the model is tested. In chapter 6 the case study at Sony Ericsson is further presented. A discussion regarding how well the model was applied at the case together with an overall analysis of the model is thereafter presented in chapter 7. Finally, our conclusions are presented in chapter 8.

2 Methodology

This chapter will describe for the reader which methodology we have used for this thesis. First, the reader will be introduced to the overall work process and later, a deeper explanation of which techniques that have been used to make the study trustworthy will be presented.

2.1 Overall Work Process

In the search for an interesting topic to study, we came in contact with Sony Ericsson who was facing a strategic decision in supply chain and wanted guidance on how to objectively evaluate this decision. Sony Ericsson is a global company in the mobile handset industry. With production in Asia and Latin America and suppliers and customers placed all around the world, Sony Ericsson faces all the challenges of a global competitive environment described in the background in this thesis.

In our attempt to find academic research made on the topic strategic decision-making in supply chain, we were surprised when little was discovered. For example when searching for “Strategic decision-making in supply chain” in the search engine; Electronic Library Information Navigator (ELIN), only one article was found handling procurement. After ascertaining that there was not any apparent recipe in former studies on how to tackle the issue Sony Ericsson was challenged with, we initiated the work of creating our own decision-making model. Information was gathered mostly from academic articles and journals and hence, a deductive approach was used in order to help Sony Ericsson to make a decision based on relevant information.

The way in which theoretical and empirical findings are presented and analyzed in a study can be approached in two different ways; deduction and induction. In the deductive approach, the theoretical framework is developed before conducting an empirical analysis. Hence, the empirical study falsifies or verifies the theory. The inductive approach functions in the opposite way; beginning with empirical data collection and then constructing a theoretical frame to process the empirical findings. (Kjørup, 1999) This study takes its standpoint from theories concerning; strategy, supply chain management, and decision-making. Further, these theories have been merged and in that way, used to create a model for strategic decision-making in supply chain. The model was later tested on the case at Sony Ericsson. The deductive approach has been criticized for the risk of the researcher having expectations prior to initiating the research and this could limit the access to information and can result in important information being overlooked (Jacobsen, 2002). While conducting the study we have been aware of the criticism and have attempted to consider all perspectives and keep an open mind.

2.1.1 Case Study

When testing the model on Sony Ericsson, we conducted a single case study. Case studies are used as a research method in many different disciplines when a deeper understanding of an observed existing phenomenon in real-time is needed (Yin, 1994). A case can be; a single organization, a single location, a person, or a single event. The emphasis tends to be on the intense examination of the setting. (Bryman and Bell, 2003) Our case study at Sony Ericsson was conducted intensively during two months spent in Beijing.

Yin further proposes that one rationale for a single case study is when the case represents a critical case when testing a formulated theory. To confirm, challenge, or extend a theory there may exist a single case, meeting all the conditions for testing the theory. The single case can be used to determine whether a theory's propositions are correct or whether some alternative set of explanations might be more relevant. (Yin, 1994) This method supports our purpose in attempting to develop a theoretical model applicable for strategic decision-making in supply chain and testing it on the case at Sony Ericsson. A potential vulnerability of the single-case design is that a case may later turn out not to be the case it was thought to be at the outset (Yin, 1994). In order to prevent this from occurring, we had to decide with the help of our sponsor at Sony Ericsson that no matter what happened in the rest of the organization during our study, our assignment, i.e. the case, would not change significantly.

When conducting a single case study there are two different designs available; holistic and embedded. The holistic design examines only the global nature of the single case and the embedded design is when the single case study consists of different subunits and analysis might include outcomes from the different subunits. An embedded case study methodology provides a means of integrating quantitative and qualitative methods into a single case study. (Yin, 1994) We have used the embedded design in our single case study to be able to breakdown and consider the different perspectives that strategic decision-making in supply chain entails. The different supply chain members that were consulted during the single case study can be considered subunits.

2.1.2 Analyzing the Decision Model

To be able to draw conclusions regarding how well the developed decision-making model worked on the case performed at Sony Ericsson, the model was at last analyzed.

A discussion was held about the model's theoretical foundation, a rational decision-making model, and whether or not it was a good choice to use it. Additionally, we analyzed the theoretical content that was added and modified to make the rational decision-making model suitable for strategic decision-making in supply chain, step by step.

Moreover, we have used Wacker's (1998) key evaluation factors from a framework that he has developed in how to analyze generated theories. Our model was not an attempt to create a new theory, but was evaluated as a theoretical contribution to the decision-making theory. The framework consists of eight factors on which the model can be assessed; we have focused on three of them. Hence, the model was assessed according to *Uniqueness*, *Conservatism* and *Generalizability*. The meanings of them are further explained below and are later used in the discussion in chapter 7.

- *Uniqueness* – Two theories must be differentiated from each other, or else they should be considered a single theory.
- *Conservatism* – A present theory can not be replaced by a new one, unless the new theory is superior to the present. Therefore, a present theory should not be rejected for the sake of change.
- *Generalizability* – The more types of environments a theory can be applied to, the better theory it is and hence, the more it can be utilized. (Wacker, 1998)

2.2 Data Collection

There are two different methods for collecting data; qualitative and, quantitative. The nature of the research topic will ultimately decide which method is suitable. Qualitative and quantitative research explains how the information gathered is approached and processed. The qualitative method allows a deeper and more detailed understanding of the problem at hand. Observations and interviews are commonly used tools within the qualitative method. The quantitative method is more formalized and structured, and is more concerned with numbers and anything that is quantifiable. (Holme and Solvang, 1997)

In some cases complementary methods are used in the belief that weaknesses inherent in one approach will be counterbalanced via strengths in another, thus increasing validity and reliability in a study, which is referred to as triangulation. Quantitative and qualitative methods complement each other, providing richness or detail that would be unavailable from one method alone. (Jack and Raturi, 2006)

When conducting the case study at Sony Ericsson an overall qualitative method was used. The most significant empirical findings were gathered when conducting interviews. But in order to attain a comprehensive view of the case, a triangulation approach, merging qualitative and quantitative data, was used. The quantitative data collected was gathered by financial reports and invoices given by Sony Ericsson.

2.3 The Character of the Data

Sources are generally divided into two categories; primary sources and secondary sources, depending on originality and proximity to the source or origin. A primary source is a source containing new information authored by the original researcher. A

secondary source is a source wherein another author comment or otherwise reprocess primary information. (Duff, 1996)

2.3.1 Primary Sources

As previously described, we have used a qualitative method when performing the case study. The primary data has therefore been collected through open qualitative interviews on Sony Ericsson employees and people from their supply chain involving; a supplier, the third part logistics partner and a factory.

The qualitative interview technique is the interview mode in which the interviewer is least likely to influence the interviewee. Instead, the interviewer will try to get the interviewee to influence the direction of the conversation, while still ensuring that the desired questions are responded to. The interviewer must make the interviewee feel comfortable in the situation; this will be achieved when the interviewer is observant and open in the conversation. (Holme and Solvang, 1997) Individual interviews inevitably bring out personal attitudes towards the topic and it is therefore crucial to compare and critically question the answers that are gathered in order to minimize the influence of personal opinions (Bryman and Bell, 2003). In this thesis we have been interested in collecting data and let people express their opinions and motives. During some of the interviews, we asked the interviewee to visualize their thoughts by drawing sketches on the white board. In this way, we were better able to understand their ideas. Since many interviews were conducted with Chinese employees it was important to make them feel comfortable and hence, small talk was made prior the interview. Most interviews conducted for this study were made face-to-face, otherwise interviews made via telephone. Some follow-up questions were answered via e-mail, when further face-to-face meetings were not possible.

We had the privilege to sit and work close to the person initiating the project being evaluated, and also, the organization that would be most affected by the decision. Consequently, we were able to have many informal discussions in between the scheduled meetings. In this way, we were able to obtain opinions and information from many perspectives which raised our overall knowledge about the question at hand. Being present in the Beijing office, where the organization was placed, also had the advantages of being able to talk to people working in the factories, which otherwise would not be possible. The topic itself was well known, hence it was easy to get people to talk about it and express their opinion. We have throughout the case study been in close contact with an experienced, former, project team within the field of our study which functioned as our support when we needed advice and information. Taking their thoughts and experience into consideration was important to us, even though we tried to stay objective all the time, since their knowledge about Sony Ericsson and the supply chain is much higher than our.

2.3.2 Secondary Sources

The method for data collection to find suitable theories in order to create a theoretical framework has been through a comprehensive literature study. Books and articles from Lund University library and search engine ELIN have been used. Secondary sources in terms of reports and company internal information such as presentations from Sony Ericsson have also been collected.

2.4 Reliability and Validity

Reliability and validity are prominent criteria for the evaluation of business and management research (Bryman and Bell, 2003).

Reliability is concerned with to what extent the presented information is reliable and representative. It also relates to whether the results of the study are repeatable. (Bryman and Bell, 2003) *Validity* refers to the integrity of the conclusions that are generated from a piece of research. *Internal validity* means that the method actually examines what was supposed to be examined. *External validity* concerns the extent to which the research results can be generalized beyond the specific context of a study. (Holme and Solvang, 1997; Bryman and Bell, 2003)

Interviews collect information about personal opinions and as such it is quite difficult to ensure the reliability. When conducting a literature study, the reliability depends on the researcher's ability to stay focused on the text and not overlook important information. (Jacobsen, 2002)

Having a theoretical framework set when conducting interviews and collecting data facilitated finding secure and valid data. Key findings were documented during the interviews in order to secure that we both had perceived the same information. All data has been processed by both of us to enhance reliability and decrease the risk of biased interpretations. When conducting the interviews both of us were always present to ensure that all the data gathered was crosschecked and that both of us were aware of the context of the answers. This was done in order to maximize the validity and reliability of the study. Many people were also asked the same questions to facilitate reliable facts. Further, throughout the study our aim has been to keep a critical standpoint and thus pick up on possible lack of objectivity of respondents and secondary sources.

3 Theoretical Framework

In this chapter, the theories that constitute the foundation of the theoretical framework of our model: decision-making, strategy and supply chain management will be presented.



Figure 3.1: The theoretical framework consists of a combination of Decision-Making, Strategy, and Supply Chain Management theories.

Figure 3.1 describes which areas that we will discuss in this theoretical framework to be able to construct the strategic decision-making model suitable for supply chain. Also, it can be viewed as a disposition of the entire chapter. The first section, 3.1, focuses on *decision-making*, which will be the foundation of our model. From the following sections; 3.2 *strategy* and 3.3 *supply chain management* and the belonging subsections, we will further extract the most important information found in these theories.

3.1 Decision-Making

Organizations are constantly faced with different decisions where they have to select an alternative from those available (Kao and Kao, 2007). Decision-making is done at all levels of a company. Every organizational process, every action, demands a decision. These decisions determines the efficiency of the organization, hence, it is important that these decisions are rational. (Bruzelius and Skärvad, 2008) The traditional approach towards decision-making within economical theories is rational decision-making (Hatch, 2002). The rational decision-making process describes how

the decision-maker should behave in order to maximize the outcome (Robbins, 2003; Harrison, 1995).

Stephen Robbins (2003) presents in his book, *Organizational behavior*, a rational decision-making model, which consists of six steps, which can be viewed in figure 3.2.

- | |
|---|
| <ol style="list-style-type: none">1. Define the problem2. Identify the decision criteria3. Allocate weights to the criteria4. Develop the alternatives5. Evaluate the alternatives6. Select the best alternative |
|---|

Figure 3.2: Steps in the rational decision-making model (Robbins, 2003).

The rational decision-making model, see figure 3.2, begins by defining the problem. The problem is the discrepancy between the existing and the desired state. Once the decision maker has defined the problem, he or she will have to identify the decision criteria that will be important in solving the problem. The identified criteria are not often of equal importance, hence the third step will be to weigh the criteria and give them the correct priority in the decision. In the fourth step the decision-maker will have to generate possible alternatives to resolve the problem. Once the alternatives have been generated, the decision-maker needs to critically analyze and evaluate them, which is done in step five. Finally in the last step, the alternatives will be evaluated against the weighted criteria and the best matching alternative will be selected. (Robbins, 2003)

The rational decision-making model has been criticized by Herbert Simon, who identified and questioned the assumptions that the rational model is based on. According to Simon, economic theory presupposes that the “economic man” in his course of being economic is also rational. “Economic man” is assumed to have knowledge of all relevant aspects of his environment, a well-organized and stable system of preferences, and a skill in estimating which course of action will maximize the outcome of the decision. At best, the human mind can make simplified estimates to be able to manage the complex situations that an individual can be put in. (Simon, 1955)

However, as Edlund et al (1999) point out, if a decision-making process is poorly structured, a firm runs the risk of never actually taking a decision. Hence, although the decision-maker is not always as rational as assumed in the rational decision-making model, the model can still provide the decision-maker with structure and guidance in aspiring to be more rational. (Edlund et al, 1999) Dawes (1988) means that we can not think of our decision options, and their possible consequences,

simultaneously; we must do so sequentially. The resulting order in which we consider options and consequences may have profound effects on decision-making. (Dawes, 1988) The rational decision-making model helps the decision-maker to structure and organize the decision-making process (Bakka et al, 1994). Harrison argues that to make a decision rational it is important that an objective exists and that the decision-maker perceives and selects an alternative that promises to meet the objective. Within firms these objectives are often derived from the firm's strategy. (Harrison, 1995)

3.2 Strategy

The term strategy derives from the Greek word *strategia*, formed from *stratos* meaning "army" and *agein* "to lead". Strategy in an enterprise is about ensuring the survival and prosperity of the firm. (Grant, 2005)

The classical approach to strategy relies on rational planning to achieve profitability (Whittington, 2001). Alfred Chandler (1962) was one of the first to define the term strategy; "Strategy is the determination of the basic, long-term goals, and the adoption of course of action and the allocation of resources necessary for those goals." (Chandler, 1962)

Strategy defines the scope of a firm, in terms of industries and markets which it competes in. It is also concerned with how the firm competes within the industries or the markets. If a firm is to prosper within an industry, it must establish a competitive advantage over its rivals. (Grant, 2005) A strategy will help a firm take a more proactive approach towards shaping its environment, as opposed to simply reacting passively to it (Heracleous, 2003). The classical approach to strategy places great confidence in managers and their readiness and capacity to adopt profit-maximizing strategies through rational long-term planning (Whittington, 2001).

Barney criticizes the classical approach for being overly reliant on external opportunity-maximizing and thus downplays internal aspects in their approach to strategy. A firm's resources include; tacit skills, patterns of co-operation, and intangible assets that take time and learning to evolve and should, according to resources-theorists, not be downplayed. The key to long-term success lie internally, in the capacity to exploit and renew distinctive resources, rather than externally, simply positioning the firm in the right markets. (Barney, 1991)

Weick (1990) tells the story of a Hungarian detachment that got lost in the Alps during military maneuvers. As it snowed for two days, the soldiers despaired and laid themselves down to die in the frozen wilderness. Then suddenly one of the soldiers found a map in his pocket, the detachment took heart and they marched confidently out of the mountains. Safe back at the camp, they discovered the map was of the Pyrenees. (Weick, 1990)

Weick argues that strategic plans are a lot like this map; it does not matter much if they are imperfect as long as they give managers the confidence to act. If the firm sits

and waits for the right map it will freeze but if it gets up and moves, it will somehow find direction, acquire experience and create its own opportunity. (Weick, 1990)

Whittington argues that strategies are used by managers to try to simplify and order a world which is too complex and chaotic for them to comprehend. Strategic planning with its regular procedures and precise quantifications are comforting rituals, managerial security blankets in a hostile world. (Whittington, 2001)

Strategy is a crucial determinant of a firm’s performance, it also gives managers the confidence to act, and hence, formulating a strategy is important (Bowman and Helfat, 2001). When formulating a strategy, it is in the best interest of a firm to balance external opportunity with internal competence and resources (Heracleous, 2003). Grant has created a framework of analytical tools, including both external and internal influences that a firm can use when developing a strategy, see figure 3.3.

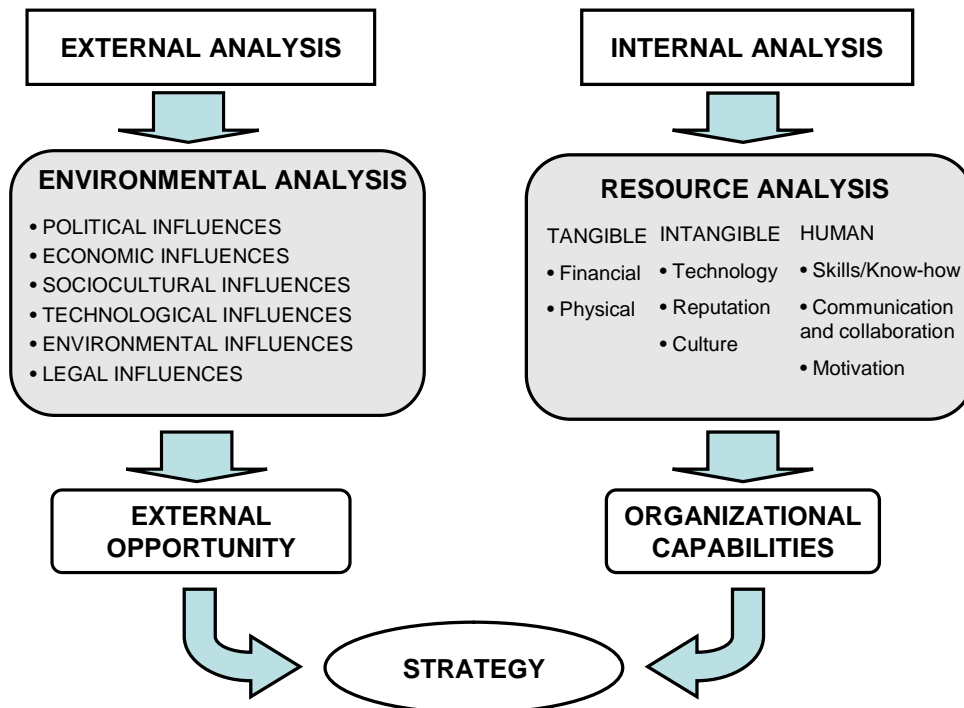


Figure 3.3: The basic framework of strategy as a link between the firm and its environment (Grant, 2005).

As shown in figure 3.3; the external influences of the firm comprise the whole range of environmental factors that influence the firm. The internal influences relates to identifying the uniqueness of the firm’s internal resources and capabilities through which a firm can establish competitive advantage. (Grant, 2005)

Strategy formulates the firm’s goals and the direction to achieve them, to reach the desired goals there are many strategic decisions to be made (Grant, 2005).

3.2.1 Strategic Decision-Making

Strategic decisions are oriented towards the future and are therefore fraught with the uncertainty of outcomes yet to be realized. These kinds of decisions require a good deal of study and analysis. (Harrison, 1995)

Grant (2005) believes that strategy is a pattern or theme that gives coherence to the decisions of an organization. Strategic principles can help the decision-making by constraining the range of decision alternatives considered. Strategy not only simplifies decision-making, it can also facilitate the decision process with analytical tools like external analysis, internal resource analysis and financial analysis. (Grant, 2005) These techniques can help the decision-maker to structure the options in a more rational manner (Whittington, 2001). Within classical strategic decision-making the importance of using financial analysis is especially emphasized since strategic decisions are about rational profit maximization. As markets globalize, competitive pressure for excellence increases, and underachieving firms face growing threat of takeover, Grant (1991) argues that rational decision-making techniques are becoming increasingly important in the current business environment. Firms can not afford to diverge from the goal of long-term profit maximization. (Grant, 1991)

According to Harrison (1995) strategic decisions are those which are important to an organization, through the scope of their impact and/or through their long-term implications. Strategic decisions can be classified in to at least three broad categories; (1) decisions related to product/service domain of a given organization, (2) decisions related to the development and implementation of a technology for serving the product/service domain, and (3) decisions related to the differentiation and integration of an organizational structure. (Harrison, 1995)

3.3 Supply Chain Management

Supply chain management is considered to be the systematic, strategic coordination of the traditional business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole (Mentzer et al, 2001).

In the face of intense competition, rapidly changing technologies, and evolving customer requirements, no firm alone can accomplish the complete process of meeting the demands of the market. Business is moving towards new perspectives of closely coordinated, co-operative networks that are competing with other networks. With this development supply chain management is becoming a competitive advantage for a firm and more essential to strategy. (Schary and Skjøtt-Larsen, 2003; Schentzler et al, 2007)

“Supply chain management is the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders.” (Lambert and Cooper, 2000)

Supply chain management grasps every effort involved in producing and delivering a final product or service, from the supplier’s supplier to the end customer. It includes managing supply and demand, manufacturing and assembly, warehousing and inventory tracking, sourcing, order handling, and distribution. (Duclos et al, 2003) Ideally, supply chain management should embrace all business processes cutting across all organizations within the supply chain, from initial point of supply to the ultimate point of consumption (Lambert et al, 1997). It should link all of the partners in the chain, from suppliers, third party companies, carriers, information system provider, retailers, and customers to other external partner, as well as the different departments within the organization. In a supply chain, each member’s performance will affect the overall performance; hence a key point in supply chain management is that the entire process must be viewed as one system. (Duclos et al, 2003)

With an organization’s long-term goal being profit maximization, supply chain management is primarily focused on reducing cost. Lambert and Stock (2001) emphasize that one of the major goals of an organization should be to reduce the total cost of logistics activities rather than focusing on each activity in isolation. They present a framework, the total cost analysis, with six major cost categories of logistics; transportation, warehousing, order processing and information, lot quantity, inventory carrying and customer services level, as shown in figure 3.4, This can be used when managing the cost structure in the supply chain to avoid sub optimization. (Lambert and Stock, 2001)

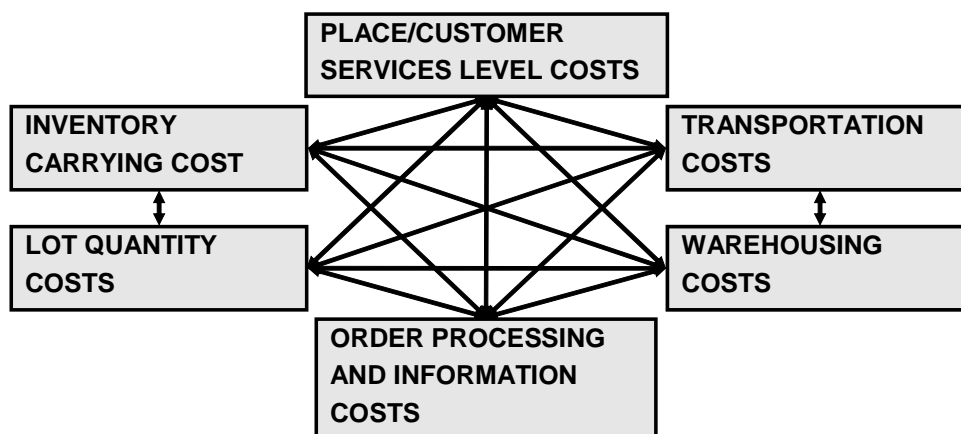


Figure 3.4: The total cost analysis framework (Lambert and Stock (2001)).

Transportation costs – include the inbound and the outbound transportation costs.

Warehousing costs – include warehousing and storage costs.

Order processing and information costs – include the cost for the information system, order processing costs, logistics communication costs and forecasting and planning costs.

Lot quantity costs – include cost due to buying and producing in different quantities.

Inventory carrying costs – include the capital cost of the inventory, insurance and tax costs on inventory and inventory risk costs (risk for obsolescence).

Customer service costs – include the cost of lost sales, order fulfillment cost and costs for service and parts. (Lambert and Stock, 2001)

3.3.1 Strategic Supply Chain Management

Strategic supply chain management should focus on developing; objectives and policies for the supply chain, the shape of the supply chain in terms of facilities and locations, and the outline of the organizational structure so that it supports and integrates the supply chain effectively (Stevens, 1990).

Supply chain objectives in alignment with the corporate strategy

It is important to develop a supply chain strategy in alignment with the corporate strategy to enable supply chain management to make an optimal contribution to business success. This can be achieved by systematically translating the strategic priorities of the company into supply chain management objectives. For example, if the company strategy puts a priority on rapid delivery it makes no sense to primarily reduce stock which can become a disadvantage of delivery. The key competitive capabilities in supply chain strategy are broadly expressed in terms of (1) *low cost*, i.e. logistics costs, infrastructure and inventory, (2) *flexibility*, explained by managing changes and uncertainties, (3) *quality*, in the sense of meeting higher customer demands, (4) *delivery reliability*, meaning punctuality and delivery reliability rate and (5) *delivery lead time* referring to delivery times and high fill rate. (Chen et al, 2004; Schentzler et al, 2007)

To have a supply chain strategy in alignment with the corporate strategy is important, but it is also important that the supply chain strategy is consistent across all supply chain members, as displayed in figure 3.5. The consistency in supply chain strategy across the supply chain members does not imply that each firm's strategy needs to be the same, rather, that the strategies should be complementary across firms to support overall, shared supply chain objectives. It is important to create structures, processes and relationships that improve the cross-organizational behavior between supply chain members that share a common vision and objectives. (Defee and Stank, 2005)

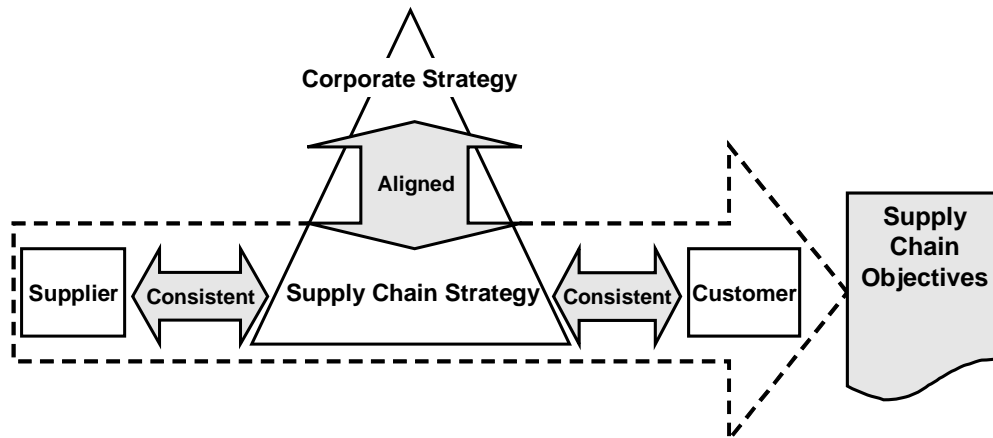


Figure 3.5: Supply chain strategy aligned with corporate strategy generates the supply chain objectives that should be consistent throughout the supply chain.

Strategic model of the supply chain

Schary and Skjøtt-Larsen present a strategic model for analyzing the supply chain through three perspectives; structure, process, and relationships, as visualized in figure 3.6. Structure deals with developing the structural dimensions, choosing partners and analyzing the cost structures. Process involves the sequence of activities, the path through which information and material flow. Relationships define the connections between the organizations, illuminates the power relations and the willingness to cooperate in the supply chain. Structure, process, and relationships are essential when describing, analyzing and managing the supply chain. The three components are closely connected to each other. (Schary and Skjøtt-Larsen, 2003)

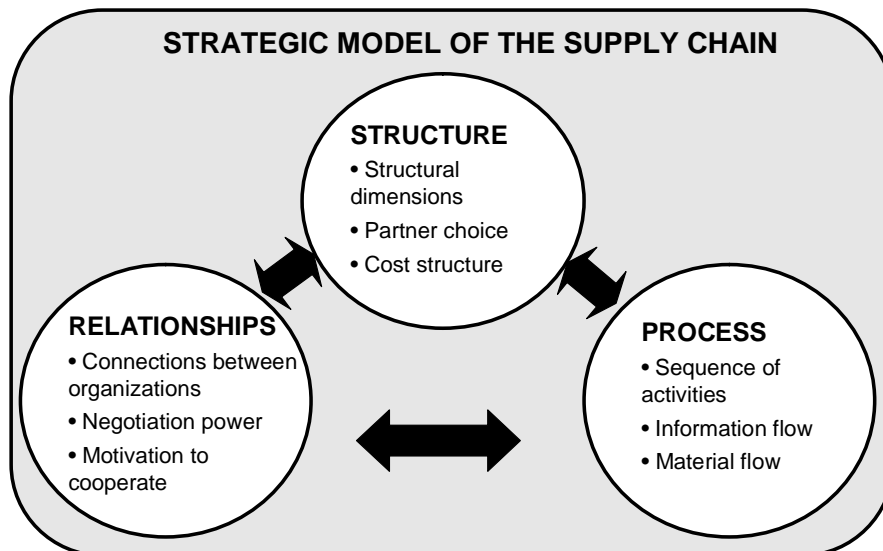


Figure 3.6: A visualization of Schary and Skjøtt-Larsens' strategic model of the supply chain.

Structure

- *Structural dimensions* – deals with the physical structure of the supply chain.
- *Partner choice* – refers to the choice of partner and also the choice of responsibilities to be assigned the partner, e.g. the partner might take over an activity previously performed by the firm.
- *Cost structure* – relates to managing the cost structure in the supply chain, since reducing cost in one logistic activity can lead to cost increase in others. (Schary and Skjøtt-Larsen, 2003)

Process

- *Sequence of activities* – illuminates the order in which the activity in the supply chain should occur.
- *Information flow* – handles both the information system that enables the information transfer between the organizations and what information should be shared between partners.
- *Material flow* – deals with the coordination of material flows and the shifting of the ownership of the material. (Schary and Skjøtt-Larsen, 2003)

Relationships

- *Connections between organizations* – identifies the level of relationships between partners.
- *Negotiating power* – establishes the bargaining position between the partners in the supply chain.
- *Motivation to co-operate* – deals with the willingness to coordinate operations, share information and other resources, and contribute to the management of the supply chain as a whole. (Schary and Skjøtt-Larsen, 2003)

3.3.2 Decision-Making in Supply Chain

When making decisions in supply chain it is important to focus beyond the firm's boundaries to include the impact of and on other supply chain members (Stank et al, 2005). Lee (2004) emphasizes the importance of alignment within the supply chain; if any company's interests differ from those of the other members in the supply chain, its actions will not maximize the supply chains performance. Incentives need to be formulated, so that when companies try to maximize returns, they also maximize the performance of the entire supply chain. Therefore, it is crucial for a company to try to predict the possible behavior of the supply chain partners depending on the incentives. (Lee, 2004)

Defee and Stank (2005) conclude that centralized planning and decision-making has shown to lead to better overall control and greater operational flexibility. They suggest that the supply chain leader should take the role of coordinating and controlling the centralized planning and decision-making, leading to better consistency of supply chain activities. (Defee and Stank, 2005)

4 Strategic Decision-Making in Supply Chain

In this chapter we will begin with summarizing the key findings from the theoretical framework. Thereafter, the construction of the strategic decision-making model for supply chain will be illustrated. Finally, we will present the developed model; The Decisive Model.



Figure 4.1: The void that will be filled with the developed model, The Decisive Model.

Figure 4.1 visualizes the purpose of this chapter, which is to fill the void found between decision-making, strategy and supply chain management. Later in this chapter the developed model, *The Decisive Model*, a strategic decision-making model for supply chain, will be presented.

4.1.1 Summary of the Key Findings from the Theories

Decision-making – The rational decision-making model helps the decision-maker to structure and logically process information sequentially (Bakka et al, 1994; Dawes, 1988; Edlund et al, 1999; Robbins, 2003).

Strategy – Strategy facilitates the decision process by providing the decision-maker with analytical tools like external analysis, internal resource analysis and financial analysis (Grant, 2005; Heracleous, 2003). Strategic analysis gives the managers the confidence to act (Weick 1990; Whittington, 2001).

Strategic decision-making – Strategic principles help the decision-maker by creating objectives and thereby constraining the range of decision alternatives considered (Grant, 2005; Harrison, 1995).

Supply chain management – Supply chain management enlarge the internal scope of the firm to include the firm's supply chain (Scharj and Skjøtt-Larsen, 2003; Schentzler et al, 2007). Within a firm supply chain management is mostly concerned with reducing costs and the total cost analysis helps the manager to avoid sub optimization (Lambert and Stock, 2001).

Strategic supply chain management – Strategic supply chain management highlights the importance of having supply chain objectives in alignment with the corporate strategy to make an optimal contribution to business success (Chen et al, 2004; Schentzler et al, 2007).

Decision-making in supply chain – Decision-making in supply chain emphasizes on the importance of focusing beyond the firm's boundaries to include the impact of and on other supply chain members and predict their possible behavior, when making decisions in supply chain (Lee, 2004; Stank et al, 2005).

The presented key findings will be considered when constructing the strategic decision-making model for supply chain in the following section.

4.1.2 Constructing a Strategic Decision-Making Model for Supply Chain

The rational decision-making model, presented in chapter 3.1, *Decision-making*, figure 3.2, will be used as a foundation. We believe that the rational decision-making model is the most suitable foundation for structuring the complex decision process since it helps the decision-maker to logically process all information that needs to be considered when making a strategic decision in supply chain. We have added, eliminated or modified some of the steps in the model to suit the specific characteristics that need to be considered when making a strategic decision in supply chain. A thorough, step by step, explanation of the configurations of the model will be given below.

The first step will remain intact:

“Step 1: Define the problem – *the problem is a discrepancy between an existing and a desired state of affairs. In this step it is crucial to define the desired as well as the existing state clearly, to avoid ambiguity, and to give a complete description of the decision situation.*” (Robbins, 2003)

We have added a new step between step one and two in the model:

“Step 2: Identify concerned supply chain members – *map all the affected supply chain members and select a small group of key people representing all the different types of concerned stakeholders. The key people can then be consulted as a group or individually when evaluating the decision alternatives in step 5.*”

As discussed in chapter 3.3.2, *Decision-making in supply chain*, it is important to look beyond the boundaries of the firm when making a decision in supply chain (Stank et al, 2005). The decision will probably affect other supply chain members; therefore a

group of key people representing the different stakeholders can help the decision-maker to get a better understanding of how the decision will affect other supply chain members, and to try to predict their possible behavior (Lee, 2004).

Former step 2 will now become step 3, which has been modified:

“Step 3: Identify the strategic decision criteria – ensure that the supply chain objectives are aligned with the corporate strategy and set the decision criteria in accordance with the supply chain objectives.”

As discussed in chapter 3.3.1, *Strategic supply chain management*, it is important to have a supply chain strategy in alignment with the firm’s corporate strategy when defining the supply chain objectives (Chen et al, 2004; Schentzler et al, 2007). As discussed in chapter 3.2.1, *Strategic decision-making*, strategic principles will help the decision-maker by constraining the range of decision alternatives considered (Grant, 2005). Therefore, we believe that setting decision criteria in accordance with the supply chain objectives helps the decision-maker to constrain the range of decision alternatives considered.

Former ***“Step 3: Allocate weights to the criteria”***, has been eliminated. We believe that when the decision criteria are derived from the supply chain objectives it can be difficult to weigh the criteria against each other, since they combined are suppose to fill a strategic goal.

Step 4 will remain intact:

“Step 4: Develop the alternatives – generate possible alternatives that could succeed in resolving the problem.”

Step 5 has been modified:

“Step 5: Evaluate the alternatives – critically analyze and evaluate the alternatives with the help of an analytical toolbox consisting of; external macro-environmental analysis, PESTEL, the strategic model of the supply chain, and the total cost analysis.”

When making strategic decisions, Grant (2005) suggests using external analysis, internal resource analysis and financial analysis to facilitate the decision (Grant, 2005). In supply chain management the internal scope of the firm has expanded to include the firm’s supply chain, hence the internal resource analysis will not cover the new internal scope. We have therefore replaced the internal resource analysis with Schary and Skjøtt-Larsen’s (2003) strategic model of the supply chain presented in chapter 3.3.1, *Strategic supply chain management*, figure 3.6. However, the macro-environmental analysis, PESTEL, presented in chapter 3.2, *Strategy*, is still applicable since the external influences will still affect the supply chain. For financial analysis we will use the total cost analysis presented in chapter 3.3, *Supply chain management*. These three analyzes constitute our analytical toolbox, which can be viewed in the next section, 4.1.3 in figure 4.3.

Step 6 has remained intact:

“Step 6: Select the best alternative – evaluate each alternative against the criteria and select the alternative that is most aligned with the criteria.”

4.1.3 The Decisive Model

Below is the final model, generated for strategic decision-making in supply chain, presented.

Step 1: Define the problem – the problem is a discrepancy between an existing and a desired state of affairs. In this step it is crucial to define the desired as well as the existing state clearly, to avoid ambiguity, and to give a complete description of the decision situation.

Step 2: Identify concerned supply chain members – map all the affected supply chain members and select a small group of key people representing all the different types of concerned stakeholders. The key people can then be consulted as a group or individually when evaluating the decision alternatives in step 5.

Step 3: Identify the strategic decision criteria – ensure that the supply chain objectives are aligned with the corporate strategy and set the decision criteria in accordance with the supply chain objectives, see figure 4.2.

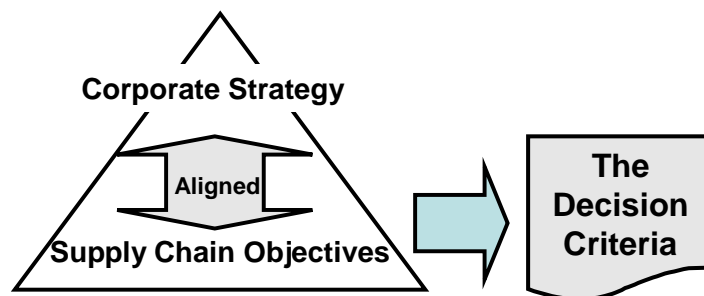


Figure 4.2: Supply chain objectives aligned with the corporate strategy becomes the decision criteria.

Step 4: Develop the alternatives – generate possible alternatives that could succeed in resolving the problem.

Step 5: Evaluate the alternatives – critically analyze and evaluate the alternatives with the help of an analytical toolbox consisting of; external macro-environmental analysis, PESTEL, the strategic model of the supply chain, and the total cost analysis, see figure 4.3.

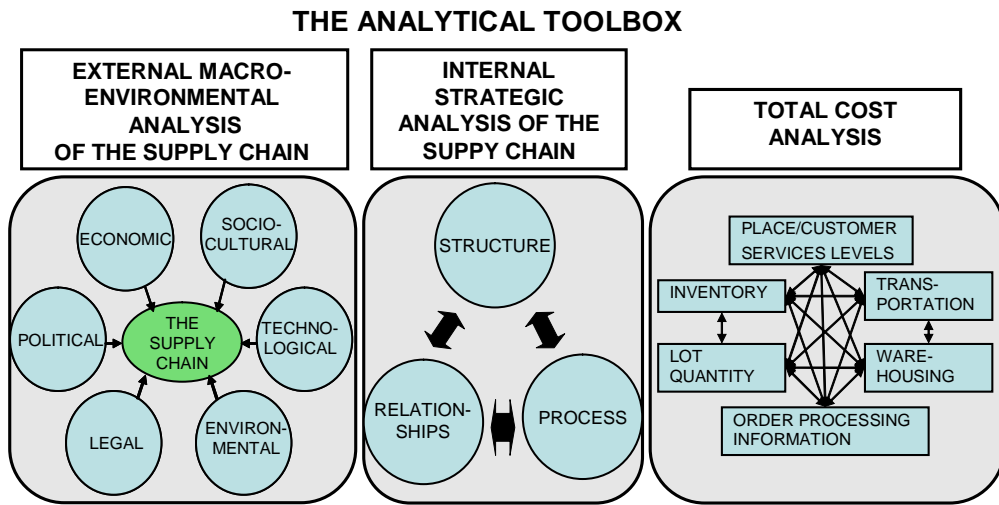


Figure 4.3: The analytical toolbox used when evaluating the decision alternatives.

Step 6: Select the best alternative – evaluate each alternative against the criteria and select the alternative that is most aligned with the criteria.

5 Sony Ericsson and their Supply Chain

This chapter will present the reader to the case company, Sony Ericsson. Further, background information about Sony Ericsson's material supply flow will be introduced in order to understand the case in chapter 6.

5.1 Sony Ericsson

Sony Ericsson is a high-tech worldwide company that employs 7.500 and serves the global communication market with mobile handsets and accessories. The company was established in 2001 when a 50:50 joint venture between Sony Corporation and Telefonaktiebolaget LM Ericsson took place. (www.sonyericsson.com, 2008-03-25) In 2007, Sony Ericsson's volume and sales grew to over 100 million units and 12.916 million euros respectively (Ericsson, 2008).

Sony Ericsson operates in a high pace industry of technological change where they need to be able to rapidly respond to customer demand. Hence, having short lead times in the supply chain is crucial in order to maintain and expand their market share. Sony Ericsson's overall goal is to grow and become number three in units sold mobile handsets. (Hellsten, 2008-04-18)

5.1.1 Centralized Procurement and Logistics

Since 2001, when Sony and Ericsson merged, the supply chain organization has gone through a lot of changes. One of the projects has been Centralized Procurement and Logistics (CPL) where Sony Ericsson has centralized all the plan-driven¹ material to one warehouse² in Hong Kong. This project was initiated by Lars Jarmander, Director of Logistics Innovation, in 2005. Previously, the suppliers delivered directly to the electronic manufacturing sites (EMS), i.e. the factories. Sony Ericsson has over 100 suppliers supplying plan-driven material to the 31 EMSs all around the world, resulting in a very complex component flow. In 2006, a centralized Vendor Managed Inventory³ warehouse was implemented. The centralized warehouse was placed in Hong Kong since 85 percent of the volume is produced in Asia and thereof mainly in China. (Jarmander 2008-03-25) Figure 5.1 visualizes the CPL-solution and describes the advantages to centralizing the material.

¹ The generic material used in the mobile handsets, planned according to a forecast. (Jarmander, 2008-01-31)

² This will also be referred to as a hub in the thesis, which is the same as a warehouse.

³ A Vendor Managed Inventory is a concept within Supply Chain Management. The suppliers are responsible for replenishing the customers inventory levels within agreed limits in the customers warehouse, and the supplier normally owns the inventory until the customer consume it or according to agreement. (Ståhl Elvander, 2007)

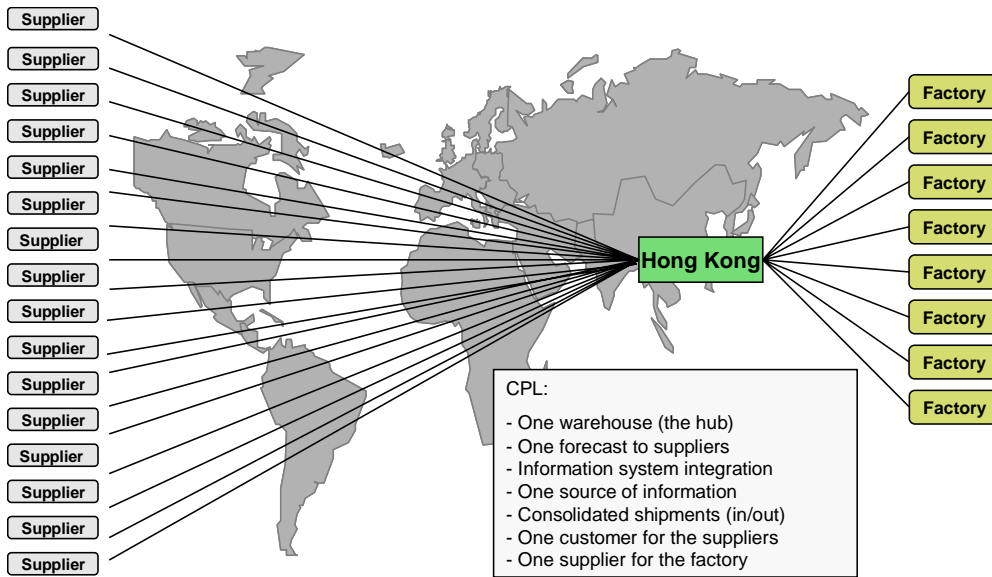


Figure 5.1: The CPL solution (Jarmander, 2007-11-28).

A third part logistics (3PL) partner, DB Schenker, is responsible for managing and operating the warehouse and all transportation into and out of the warehouse. The transportation signifies shipping the material from the suppliers to the warehouse and from the warehouse to the factories. Today 91 suppliers are on-boarded in CPL and are delivering their components to the warehouse, instead of directly to the factories. (Jarmander, 2008-02-20)

5.1.2 The Operations within Centralized Procurement and Logistics

As shown in figure 5.2, Sony Ericsson is using three standard operation procedures to describe the three main processes; inbound, outbound and warehouse operation. Thereto, three types of agreements are used to the three partners; the suppliers, the 3PL partner and the manufacturing sites. (Jarmander, 2008-02-20)

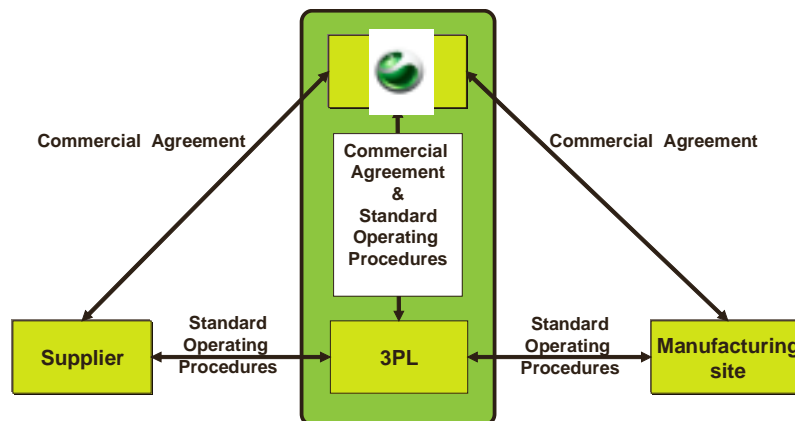


Figure 5.2: One commercial counterpart to the suppliers and the manufacturing sites (Jarmander, 2007-11-28).

1. The inbound process

The inbound process starts with Sony Ericsson sending their weekly forecast to the suppliers, forecasting the demand of the forthcoming six months. The suppliers plan their, preferably, weekly shipment that the 3PL pick-up and ship to the warehouse in Hong Kong. When the goods reach the warehouse, information about the changed inventory level will be visible for all parties. (Xie, 2008-03-17)

2. The warehouse operation process

When the goods arrive in the warehouse, the operating staff will manage the administrative handling, i.e. place the goods in to the Warehouse Managing System as well as physically place the goods in the storage shelf. Where the goods will be placed will be decided considering the material's environmental demand. (Xie, 2008-03-17)

3. The outbound process

The outbound process starts with the manufacturing sites sending a purchase order to Sony Ericsson. Sony Ericsson will then send a delivery order to the 3PL. Further, the 3PL will ship the physical order to the EMS and the information about the changed inventory level will be visible for all parties (Xie, 2008-03-17)

The order lead time is today two weeks; from that a manufacturing site sends a purchase order to Sony Ericsson until the order is shipped from the warehouse in Hong Kong. Furthermore, Sony Ericsson is responsible for ensuring that the material in the warehouse is consumed within agreed timeframes; if not, Sony Ericsson is obliged to buy the material from the supplier. (Jarmander, 2008-02-20)

The stock level for each component should be within a window decided by SEMC. The minimum level should be one week of demand and the maximum two weeks of demand. The demand is set to be the average of the forecasted next four weeks. (Hellsten, 2008-03-15)

It is important to keep in mind that the material that is shipped within CPL is in most cases very small and light weighted electronic components such as semiconductors. The components are shipped by flight transportation due to the high value and/or the high pace of demand. (Jarmander, 2008-03-20)

6 The Case at Sony Ericsson

In this chapter the strategic decision-making model for supply chain, i.e. The Decisive Model, is applied and tested on a case at Sony Ericsson. Each step, presented in chapter 4, will be performed thoroughly on the case and finally recommendations on which decision Sony Ericsson should choose will be presented.

The CPL-solution implemented at Sony Ericsson is the background to the case on which The Decisive Model has been tested. The steps were carried out in close cooperation with our sponsor and other stakeholders at Sony Ericsson.

6.1 Step 1: Define the Problem

In this step it is crucial to define the desired, as well as the existing, state clearly to avoid ambiguity, and to give a complete description of the decision situation.

Sony Ericsson's main goal is to grow and consequently, there is a need for the material supply capacity to expand. To handle an increased demand of the plan-driven material, the CPL capacity needs to grow. The warehouse in Hong Kong is today almost meeting full capacity. Currently, the warehouse has the potential to handle an increased volume to meet the forecasted demand for 2010. If the volume exceeds this level, there would be no room for flexibility and hence, it would not be able to handle a sudden increase in demand. In that case, a translocation to a larger warehouse in Hong Kong is needed. (Jarmander, 2008-02-20)

Sony Ericsson is considering alternative plans to expand the capacity in CPL; and those plans are to set up additional VMI warehouses at new locations in the world. Today, 40 percent of Sony Ericsson's production, including three manufacturing sites, is located in the Beijing area in China. These manufacturing sites run all the time, 24 hours, 7 days a week. To better be able to support these manufacturing sites Sony Ericsson is contemplating setting up an additional warehouse in Beijing. This warehouse would in that case have the same set up as the warehouse in Hong Kong. (Jarmander, 2008-02-20)

To summarize the problem, Sony Ericsson's existing state is that the capacity in CPL is reaching its limits, and the desired state is to have enough capacity in CPL to be able to meet the increasing future demand. The decision situation is how to reach the desired state.

6.2 Step 2: Identify Concerned Supply Chain Members

In this step all the affected supply chain members will be identified. Furthermore, key people representing all the concerned stakeholders will be selected to enable us to get everyone's perspective regarding the decision.

6.2.1 Supply Chain Members Affected by the Decision

Sony Ericsson's supply chain consists of suppliers' suppliers, suppliers, Sony Ericsson, third part logistics partner, factories, distributors and end consumers. In this evaluation, only the supply chain members connected to CPL were identified to be affected. Since the evaluation regards the CPL capacity expansion in the area of Beijing, only the factories in this area were considered. Therefore, the following members of Sony Ericsson's supply chain were identified to be directly affected by the decision.

- The 91 *suppliers* currently on-boarded in CPL, i.e. supplying plan-driven components to the warehouse in Hong Kong.
- The *third part logistics partner*, DB Schenker, who operates the warehouse in Hong Kong and manage all the shipping within CPL.
- The three *electronic manufacturing sites* located in the Beijing area.

Within Sony Ericsson's organization there are four departments that will be directly affected by the decision.

- *CPL Operations*, the department is operationally responsible for CPL through buying the material from the suppliers and selling it to the manufacturing sites.
- *Forecast and Control*, the department is responsible for creating the CPL forecasts to the suppliers.
- *Data Management Group*, the department is responsible for computing data in to the information system.
- *IS/IT* (Information System and Information Technology), the department is responsible for configuring the information system.

6.2.2 Key People to Consult

The key people we contacted involved participants from the three external supply chain members as well as participants from the internal departments. Externally, we came in contact with one of the largest suppliers to Sony Ericsson, the third part logistics partner's management team in Hong Kong, and one of the manufacturing sites in the Beijing area manufacturing one third of Sony Ericsson's total annual volume. Within Sony Ericsson, people from the concerned departments; CPL Operations, Forecast & Control, Data Management Group and IS/IT, were contacted. Further, people from the original CPL project team were also consulted during the investigation process. In this way, we had taken all groups into consideration and thereby, all aspects would be covered so that we would be able to give as objective recommendations as possible.

Sony Ericsson – the original CPL project team and the affected departments

The original CPL team refers to the project management team that executed the first CPL project in 2005 and was to discuss issues with us along the way. Further, from the affected departments we consulted; a purchasing manager, a senior buyer, and an account manager from the CPL Operations' team, a business analyst from Forecast and Control, a DMG coordinator from Data Management Group, and a manager from IS/IT.

Supplier – Texas Instrument

Since it was not possible to take all 91 suppliers into consideration in this study, we were given the advice to contact Texas Instrument, a supplier that works very closely with Sony Ericsson. In addition, Texas Instrument is an international company with much experience from working with different customers. Thus, a person from Customer Support and Operations Management at Texas Instrument was selected as one of the key people to be consulted during the evaluation.

Third part logistics partner – DB Schenker

The third part logistics partner, DB Schenker, is a close partner to Sony Ericsson operating the warehouse in Hong Kong and managing all the shipping within CPL. Because of their knowledge in material handling, the whole management team of DB Schenker at the warehouse in Hong Kong was selected to be involved in giving input to the evaluation.

Manufacturing site – BMC

BMC is Sony Ericsson's largest manufacturing site and it is placed in the Beijing area. BMC is also one of the few manufacturing sites that are jointly owned by Sony Ericsson, and is of great significance. BMC owns and operates two warehouses in Beijing and has knowledge of Chinese trade laws. BMC was included in the evaluation, represented by people from Procurement and the Import department.

6.3 Step 3: Identify the Decision Criteria

In this step it is important to ensure that the supply chain objectives are aligned with the corporate strategy and set the decision criteria in accordance with the supply chain objectives, see figure 4.2.

The supply chain objectives, i.e. the strategy set by the Supply Chain Operations department at Sony Ericsson was compared with the corporate strategy to ensure that these are aligned. Table 6.1 below demonstrates the corporate strategy and the supply chain objectives.

Table 6.1: Sony Ericsson's corporate strategy and supply chain objectives (Hellsten, 2008-04-18).

Corporate Strategy	Supply Chain Objectives
Sony Ericsson must <i>Grow</i> to survive	Availability/ flexibility/ growth
<i>Differentiation</i> generates <i>Defendable</i> market positions	Customer satisfaction
<i>Excellence</i> must be the standard for everything we do	Cost and capital efficiency

To see if the supply chain objectives are aligned with the corporate strategy, an analysis was made of the links between the two types of strategic goals.

- **Sony Ericsson must *Grow* to survive.** To be able to stay on the market and not to be left behind their competitors or acquired, Sony Ericsson must increase their sales. The strategy to grow is visualized in the supply chain objective ***availability/ flexibility/ growth***. (Hellsten, 2008-04-18)
- ***Differentiation* generates *Defendable* market positions.** In order to keep their market position, Sony Ericsson must have a customer focus and differentiate themselves to be able to meet all customers' different requirements. Differentiation is translated into the supply chain objective ***customer satisfaction***, since the supply chain needs to fulfill the different customers' needs. (Hellsten, 2008-04-18)
- ***Excellence* must be the standard for everything we do.** Sony Ericsson must be best in everything they do to be able to reach profit maximization. The supply chain objective ***cost and capital efficiency*** is derived from excellence. (Hellsten, 2008-04-18)

Following this assessment, it can be concluded that the supply chain objectives, in fact, are aligned with the corporate strategy. The decision criteria can therefore be set in accordance with the supply chain objectives.

A Strategic Decision-Making Model for Supply Chain – A Void to be Filled

- To enable **growth**, Sony Ericsson's supply chain will need to be able to grow with it, which makes **capacity** very important (Hellsten, 2008-04-18).
- In CPL the factories', i.e. customers', most important requirement is short lead times. To enable **customer satisfaction** Sony Ericsson must focus on having short **lead times**. (Hellsten, 2008-04-18)
- To enable **cost and capital efficiency**, Sony Ericsson needs to keep their costs down and be **cost efficient** (Hellsten, 2008-04-18).

Consequently the decision criteria are set to be:

- Increased **capacity**
- Shortened **lead times**
- **Cost efficient**

6.4 Step 4: Develop the Alternatives

In this step alternatives that could succeed in resolving the problem are generated.

To generate and develop alternatives for solving the problem, a brainstorm was conducted together with the original CPL project team at Sony Ericsson. The legal department in Lund was later consulted. Thereafter two alternatives, described below, were selected to be further investigated.

6.4.1 Alternative 1 – Increased Capacity in Hong Kong

Alternative 1 is to increase the CPL capacity in Hong Kong and increase the shipment frequency to the Beijing factories. In the current facility in Hong Kong, Sony Ericsson has the potential to grow to a certain extent, after which a new location has to be found in order to grow further. In addition, the shipment frequency would approximately increase from twice per week to once per day.

The operational solution of alternative 1 is illustrated in figure 6.2 below. The figure can be described as; the suppliers send, with the help of the third part logistics partner, the material to the warehouse in Hong Kong. The suppliers own the goods during all this time, as well as when the goods is placed in the warehouse. When a factory sends a purchase order to Sony Ericsson, Sony Ericsson buys the goods from the suppliers and ships it to the factory (showed by two lines in the figure). When the goods arrive at the Beijing airport, Sony Ericsson will sell the material to the factory.

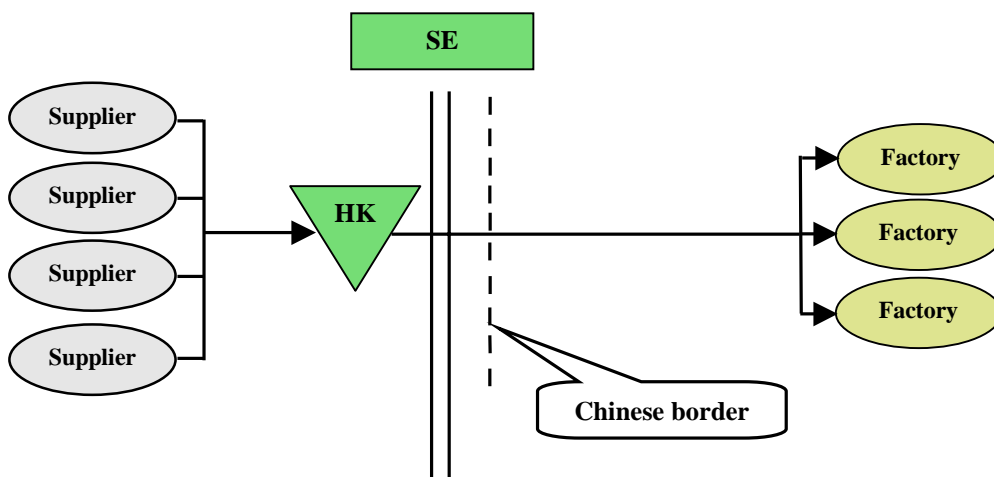


Figure 6.2: An increased frequency of the material to the manufacturing sites in Beijing.⁴

⁴ Hong Kong (HK), Sony Ericsson (SE)

6.4.2 Alternative 2 – Parallel Hub in Beijing

Alternative 2 is to set up a parallel hub in Beijing with the same capacity as the one in Hong Kong. This alternative therefore signifies a doubling of the capacity in one step. To set up a Beijing hub requires that Sony Ericsson, with the help of the third part logistics partner, find a facility within a trade zone used by international companies. Having a warehouse close to the factories enables a higher rate of shipments and hence, short lead times to the factories.

The operational solution of alternative 2 is illustrated in figure 6.3 below. In this case, the suppliers replenish two warehouses on the same conditions as the previously described alternative, i.e. they will own the material throughout the whole duration that the goods is placed in the warehouses. Sony Ericsson will take over the ownership before selling it to the factories.

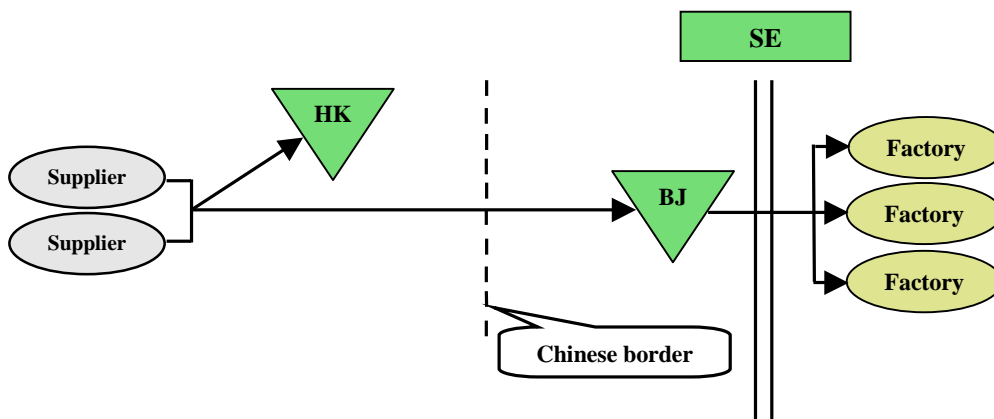


Figure 6.3: A parallel hub to Hong Kong is placed in Beijing.⁵

⁵ Beijing (BJ), Hong Kong (HK), Sony Ericsson (SE)

6.5 Step 5: Evaluate the Alternatives

In this step the alternatives will be critically analyzed with the help of the analytical toolbox consisting of; external macro-environmental analysis of the supply chain, internal strategic analysis of the supply chain, and total cost analysis, see figure 4.3. Furthermore, the key findings from each analysis will be summarized after each section.

6.5.1 External Analysis of the Supply Chain

A PESTEL analysis was conducted in order to take all macro-environmental influences in consideration when assessing the two alternatives.

Political

As a one party Communist government, politics inevitably affects business life in China. Although economic activity is becoming increasingly independent of state control, doing business in China still involves certain risks. Corruption remains a severe problem, as does lack of freedom of expression. A free press plays a key role in sustaining and monitoring a healthy democracy, as well as in contributing to greater accountability, good government, and economic development. The media in China is tightly controlled and it is not allowed to express criticism against senior leaders or their policies. (Freedomhouse, 2007) The problem of corruption is widespread and linked with new and fragmented legal framework. Arbitrary regulations increase the problem. Multiple levels of bureaucracy licensing problems are major legal and regulatory risks with the level of corruption and the enforcement problems. China's market is highly fragmented and often controlled by local political power. However, a business will probably have to deal with both national and local bureaucracies, who are not always in agreement, and Beijing may intervene at any time. (Geib, 2005)

In contrast to China, Hong Kong has a more stable political situation in regards to conducting business. The widespread problem of corruption in China, although present in Hong Kong, is not as severe. (Russell, 2007)

Impact on the alternatives

Alternative 1 will not be affected by the current political state in China since it will operate from Hong Kong (Bian, 2008-02-28). However, the political situation may affect setting up a hub in Beijing, i.e. alternative 2. Sony Ericsson should therefore be aware of the issues connected to being present in China; such as rapidly change in the political system and regulations. (Xie, Z., 2008-03-18)

Economic factors

Sony Ericsson has divided their global market into seven regions; Western Europe (WE), Central and Eastern Europe, Middle East and North Africa (CEEMEA), Asia Pacific (APAC), Latin America (LAM), China, North America (NAM) and Japan. As

seen in figure 6.4, their strongest markets are WE, CEEMEA, APAC and LAM. (Bellander, 2008-04-29)

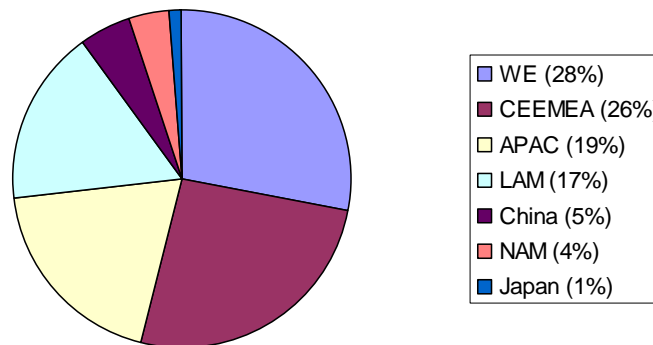


Figure 6.4: Sony Ericsson's sales (units) in 2007, distributed around the world (Bellander, 2008-04-29).

According to Nokia and Motorola, the growth in the mobile handset industry will slow down the three forthcoming years, to a growth of approximately 10 percent/year, in comparison with previous years annual growth of 20 percent (Nokia, 2008; Motorola, 2008). In table 6.5, Sony Ericsson's forecast for the total market worldwide is shown. The emerging markets; Central and Eastern Europe, Middle East and North Africa, Asia Pacific, China and Latin America will make up for most of the growth. These are markets where Sony Ericsson will need to expand their market share to be able to capture growth.

Table 6.5: The forecasted mobile handset market worldwide (Bellander, 2008-04-29).

TOTAL MARKET WORLDWIDE						
Market/year	Sold (million units)		Forecasted sales (million units)			
	2007		2008	2009	2010	2011
WE	161		163	166	168	171
CEEMEA	251		279	309	336	359
APAC	209		244	281	317	352
China	151		174	200	227	252
NAM	178		183	188	191	194
LAM	137		148	154	159	165
Japan	48		46	46	47	47
Total	1135		1237	1344	1445	1540

In 2007, Sony Ericsson sold 108 million mobile handsets, 18 percent more than the previous year and captured market share by increasing sales in emerging markets, such as Latin America and Eastern Europe (Ericsson, 2008). As shown in table 6.6, the total mobile handset market grew with 13 percent in the first quarter of 2008, to be compared with the first quarter of 2007. During the same period of time, Sony Ericsson's sales only grew with 2 percent. This indicates that there is a risk that Sony

Ericsson will not grow as much as expected in the near future. (Bellander, 2008-04-29)

Table 6.6: Sales in 2007 and the first quarter of 2008 (Bellander, 2008-04-29).

	Sold units 2007 (million)	Sold units Q1 2007 (million)	Sold units Q1 2008 (million)	Growth between Q1 2007 and 2008
Nokia	437	91,1	115,5	127%
Motorola	159	45,4	27,4	60%
Samsung	161	34,8	46,3	133%
Sony Ericsson	108	21,8	22,3	102%
LG	81	15,8	24,4	154%
Total	1135	249,4	281	113%

Impact on the alternatives

If Sony Ericsson will not grow as expected, the need for increased CPL capacity will probably not be needed to the same extent as planned. This will not affect alternative 1 in a negative way since there is a possibility for the capacity in Hong Kong to increase gradually. However, alternative 2 signifies a sudden doubling of the capacity that might not be needed.

Sociocultural factors

There could be a difference between the work ethics in Hong Kong compared to Beijing. Hong Kong has been a harbor for international trade for hundreds of years and was a British colony until 1997 (library.thinkquest.org, n.d.). This has resulted in an open and business oriented culture. Chinese society has been shaped by fifty years of communism and China did not initiate the path towards a market economy until the late 1970s, while still remaining under communist rules (Hutchings and Weir, 2006). Given its history, China has not yet fully developed a full blown business oriented culture.

Impact on the alternatives

Sony Ericsson is very pleased with the work that DB Schenker performs for them in Hong Kong. The personnel in Hong Kong are very customer focused and there could be a risk that personnel in China would not live up to the same standards. (Jarmander, 2008-04-15) Even though there might be a difference in the service mindedness between Hong Kong and Beijing, the personnel at DB Schenker works for the same company values and vision all around the world. Therefore, the sociocultural factor would probably not affect Sony Ericsson if setting up a hub in Beijing. (Wong, 2008-03-19)

Technological

The trend in the mobile handset industry is creating generic modules instead of building the mobile handsets based on platforms. If that would be the case for Sony Ericsson in the future, the variation of components will decrease which will lead to using a larger quantity of the same components. (Hellsten, 2008-04-18)

Impact on the alternatives

The technological change would be positive for both alternatives since a decreased variation of components signifies a less complex supply chain.

Environmental

Sony Ericsson use mostly air transportation when shipping components over the world (Wong, 2008-03-18). Aircraft emissions, consisting among others of carbon dioxide, affect the environment heavily and help to destroy the ozone layer which increases the global warming (www.nasa.gov, n.d.). Air transportation puts out the most emissions per kilometer compared to other transportation mediums (www.svd.se, n.d.). Even though improvements are being made to decrease the emissions of fossil fuels, there is no sign of changes and more likely the opposite will happen, an increase in emission (www.nasa.gov, n.d.). The affect of the increased emissions is enhanced attention on the global trade environment, having the potential to disturb supply chains and strategic sourcing in companies. Focus is put on environmental regulations and hence, a green supply chain is becoming increasingly important. (Hart, 2008) There is reason to suspect that companies in the future will face an increased risk of having to think about their supply chain and the way they handle their transportations. The latest media debate has indicated an increased awareness of fossil fuels and the large amount of emissions produced from air transportation. (www.svd.se, n.d.)

Impact on the alternatives

Both of the alternatives involve increased transportation, which is inevitable with increased capacity. Sony Ericsson should be aware of the debate covering green supply chains and try to avoid increasing the flight shipments unnecessarily. Alternative 1 means increasing the flight shipments from the Hong Kong hub to the Beijing factories from two flights per week to approximately seven flights per week. The second alternative means doubling almost all the inbound flight shipments since all 91 suppliers will replenish two hubs instead of one. Most suppliers replenish once a week. (Au, 2008-03-18)

Legal

To examine the legal trade issues in China is complicated and in many ways, frustrating. China is constantly changing and the regulations differ from region to region. Further, it is difficult for a company to receive accurate facts since all regional trade laws are documented in Chinese. (Xie, Z., 2008-03-20)

There are two different customs authorities in Beijing, Beijing airport customs and Bonded customs. Beijing airport customs handles all material arriving to the airport from abroad. This customs is open all days from 9 am to 10 pm. This is the customs that is used today for the material arriving to the factories from Hong Kong. (Huiqi, 2008-04-11)

The Bonded customs handles all material going through the Bonded Logistics Center (BLC), illustrated in figure 6.7, which is a trade zone close to the Beijing airport. (Xie, A., 2008-04-11)

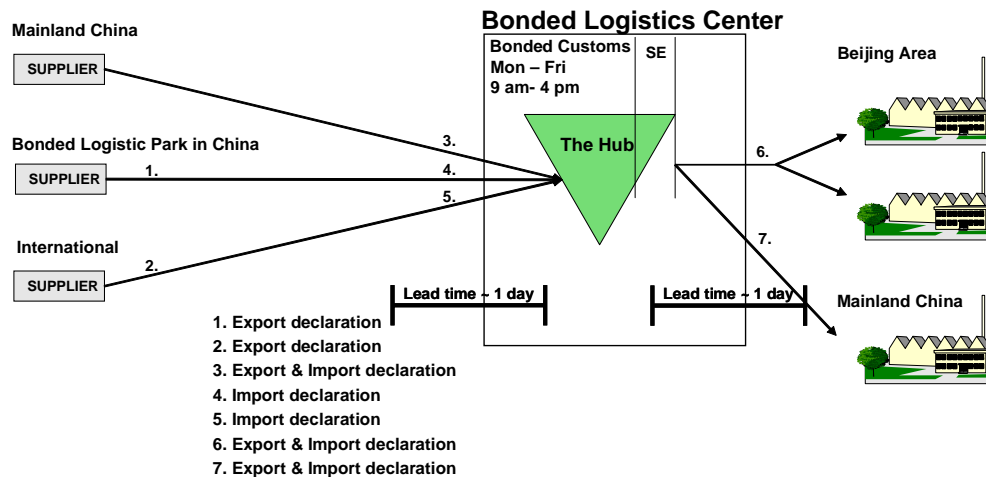


Figure 6.7: The procedures and set up in a Bonded Logistics Center.

The suppliers ship material from all over the world and can be put into three different categories; those who ship from (1) mainland China, (2) bonded logistic parks within China and (3) outside of China, i.e. international. The authorities will handle the suppliers' customs declaration of export and import differently. Despite the different procedures in handling the declarations, the administrative time will be approximately one working day for all suppliers. During this time the material will be in the hands of the authorities. (Huiqi, 2008-04-11) The BLC is a fairly new set up in Beijing and the regulations are not yet clearly defined. Described below are some issues regarding setting up a hub in the BLC.

- Sony Ericsson wants to take over the ownership over the material in the BLC, just before selling it to the factories. This means that they want to own the material only for a few hours. According to Huiqi at BMC, this will not be approved by the Chinese authorities. Sony Ericsson must either own the material the whole time in the BLC, to be able to sell it to the factories, or, if the suppliers are to own the material in the hub, the suppliers will need to sell the material directly to the factories. (Huiqi, 2008-04-11)
- The BLC Bonded customs is only open between Monday and Friday, 9 am to 4 pm. The Bonded customs needs to do export and import declarations in real-time when the goods arrive and depart from the hub. These preconditions create problems in terms of the factories not being able to buy and have the material delivered over the weekend. Consequently, the factories have no choice but to keep, at least, a two day stock of the material in their own warehouse. (Huiqi, 2008-04-11)

- It is not yet clear if the material that has been in the BLC in Beijing is considered to be bonded⁶ material in all of China. It can become an issue if any material needs to be shipped to a factory outside the Beijing area in China. (Xie, Z., 2008-03-18)

Impact on the alternatives

The Chinese legal trade issues will not affect alternative 1 since the material would, just as today; go through the Beijing airport customs.

Alternative 2, on the other hand, is affected by the trade laws to a large extent. Sony Ericsson does not want to own inventory in the warehouse, but at the same time they do not want to loose control and therefore, will not approve that the suppliers sell the material directly to the factories. Further, since the Bonded customs are open only on weekdays during office hours, it will be hard for the factories to decrease their stock level on the CPL material since they consume material during weekends. Finally, if the material from the hub in Beijing would not be accepted as bonded material in the rest of China, then the material would have to leave the country before being consumed in another factory in China.

Summery of the external factors' impact on the alternatives

P – Sony Ericsson should keep in mind that China is an unstable society where regulations can change rapidly.

E – In the current situation there is a risk of Sony Ericsson not reaching the volumes they are expecting and hence, the capacity increase might not be necessary.

S – Hong Kong has a more open and business oriented culture than China and there could be a difference in work ethics.

T – A change in the build-up of the mobile handsets could give positive effects in the distribution of components.

E – Sony Ericsson should be aware of the debate covering green supply chains since the alternatives will both signify increased air transportation.

L – The Chinese trade laws make it hard for Sony Ericsson to put up a hub in Beijing according to all of their conditions.

6.5.2 Internal Analysis of the Supply Chain

An internal analysis was made in order to find out the implications on the two alternatives in terms of changes in structure, process and relations.

Structure

Structural dimensions

Figure 6.8 illustrates how the structure of Sony Ericsson's closest supply chain would change when adding an additional hub. The structural change will be found in the beginning of the supply chain, whereas the end will not be affected to a large extent.

⁶ Bonded material – material imported to China only to be exported after value added. This material is excluded from the normal value added tax regulations in China (Bian, 2008-04-17).

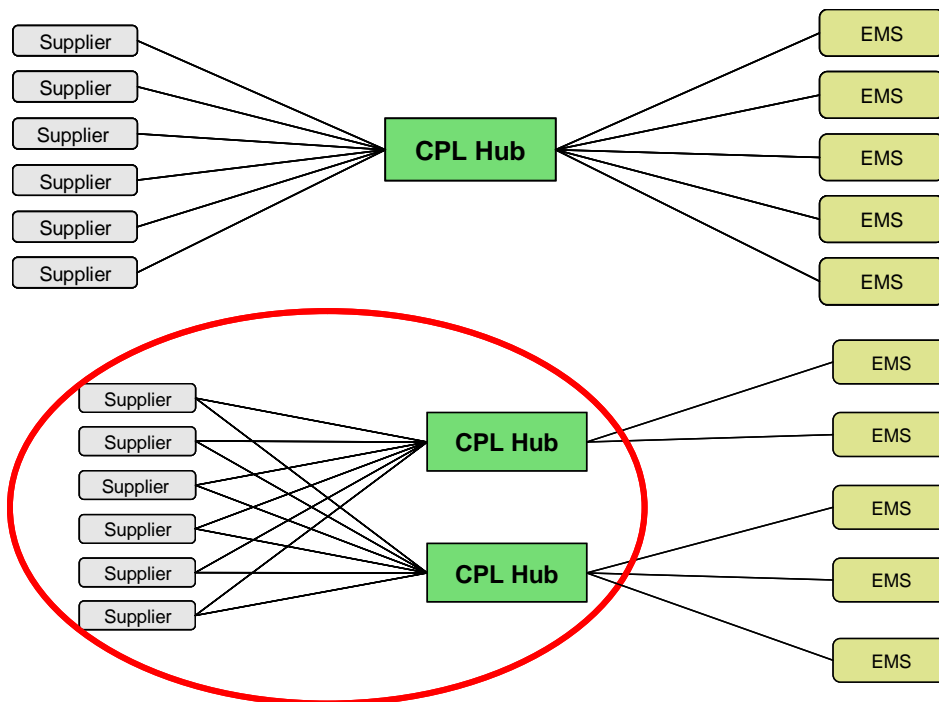


Figure 6.8: Top: The structure today. Bottom: The possible structure.

Implications for Sony Ericsson

The risks that Sony Ericsson faces with this changed structure are (1) Sony Ericsson owned inventory will probably increase since only three factories will pull material from the hub, leaving some components untouched for longer periods of time. Sony Ericsson will be forced to buy these from the suppliers. (2) At the same time there will be a higher probability of component shortage, e.g. if all factories would pull more than forecasted of one component at once. In a centralized warehouse, the fluctuation in pulling from the different factories will balance each other; hence there is a higher flexibility. (Wong, 2008-03-20)

Implications for suppliers

The suppliers will have to replenish two hubs instead of one and own inventory at two locations, which signifies greater risks for the suppliers. Risks taken by the suppliers are (1) even though supporting the same production; the inventory level in the hubs in total will increase not to lose flexibility to the factories. In that way the suppliers' inventory carrying costs will increase. (2) Handling two replenishes, i.e. responding to Sony Ericsson's forecast and arrange with shipments to two locations, will signify an increased administrative work for the suppliers. (Fayeulle, 2008-04-09)

Implications for third part logistics partner

The third part logistics partner, DB Schenker, will get an additional hub to manage and operate, and an increased number of shipments to handle (Xie, Z., 2008-03-20).

Implications for Beijing factories

The three factories located in Beijing will benefit from locating a hub there. The implications for the factories would be to get a decreased lead time, from order to delivery. This would lead to a decreased inventory level and hence, an increased inventory turnover. (Cai, 2008-04-11) On the other hand, the new structure would be more sensitive to irregular pulls from the factories, just as discussed before. Therefore, it will be more important that the factories pull on a regular basis to avoid shortage. (Li, 2008-04-02)

Partner choice

Sony Ericsson's partner choice will not change in either alternative. The suppliers and factories will be the same as before and have the same responsibility. Sony Ericsson will also keep DB Schenker as their third part logistics partner in setting up a hub in Beijing and the operational responsibilities will be the same as current. (Jarmander, 2008-03-16)

Cost structure

A total cost analysis has been performed, relating to the changes in the cost structure in the supply chain when adding an additional hub to Sony Ericsson's supply chain. It is further presented in chapter 6.5.3, *Total cost analysis*.

Process

Sequence of activities

The sequence of the activities in the three processes previously described, in chapter 5.1.2; the inbound, the warehouse operation, and outbound process, will not change when setting up a second hub in Beijing. Rather, the activities will be performed parallel to run multiple hubs, but still in the same order. (Henriksson, 2008-03-12)

Information flow

Sony Ericsson's information system and interfaces are designed to handle more than one hub, and thus only small adjustments are needed. The information shared between the partners will change slightly. The visibility in the supply chain will increase, enabling the suppliers to a larger extent to see where in the world that their components end up. With one hub only, the suppliers could only see that the components would go to Hong Kong, but not any further. (Henriksson, 2008-03-12)

Material flow

When adding a hub, there will consequently be more hubs to replenish. The increased complexity in the material flow will make consolidating shipments harder to manage. Previously, there was a possibility to consolidate some of the shipments at the pick-up place in each country where suppliers are located. Further, the ownership will not change, the suppliers will still own the material in the hubs and Sony Ericsson will buy and later, sell the components to the factories. (Au, 2008-03-19)

Relationships

Connections between organizations

The relationships between the members in the supply chain will probably only change to a limited extent.

Sony Ericsson – suppliers

It might happen that the suppliers that today co-operate close with Sony Ericsson would become an even closer partner. In the same way, suppliers with a strictly supplier-customer relationship could develop into being more perceptive towards each other and hence, increase their co-operation. (Jarmander, 2008-04-16)

Sony Ericsson – third part logistics partner

The third part logistics partner DB Schenker is already working very close to Sony Ericsson, adding a hub would only strengthen the relationship even more (Jarmander, 2008-04-16).

Sony Ericsson – Beijing factories

The relation between Sony Ericsson and the factories in Beijing will most probably not change very much. If anything, it will rather be strengthened than become weaker. (Jarmander, 2008-04-16)

Negotiating power

Suppliers

The relationship between the suppliers and Sony Ericsson is diverse depending on how large the supplier is and hence, how much they are entitled to influence Sony Ericsson. The smaller suppliers with a weaker connection to Sony Ericsson have less power and thus, can not negotiate in the same way that a larger company can. When speaking to a selected key supplier, we got the impression that there was some resistance towards adding a Beijing hub. Managing replenishments in two hubs affects a supplier much more than handling only one. Sony Ericsson is obviously the customer in this relationship and therefore they will have the best position and the most negotiating power. (Fayeulle, 2008-04-09)

Third part logistics partner

Sony Ericsson is a customer to the third part logistics partner, DB Schenker, and will therefore be the one with the negotiation power, even though a win-win situation is always wanted (Wong, 2008-04-19).

Beijing factories

Sony Ericsson more or less states the factories' terms, since it is their production. Although Sony Ericsson has the negotiating power in this relation, it is important to remember that it is the factories that actually deliver the products that Sony Ericsson sells. (Jarmander, 2008-03-12)

Motivation to co-operate

Suppliers

The motivation to co-operate might decrease for the suppliers when adding a new hub since this means, as mentioned before, increased risks and costs for them. The suppliers' willingness to co-operate is depending on how Sony Ericsson handles the change; if Sony Ericsson involves the suppliers in the change process the resistance will probably diminish and vice versa. (Fayeulle, 2008-04-09)

Third part logistics partner

The third part logistics partner's motivation to co-operate will probably be even higher than currently since a new warehouse would signify more business for them (Xie, Z., 2008-03-20).

Beijing factories

The factories' motivation to co-operate is high since a warehouse in Beijing would result in decreased lead times and decreased inventory levels for them (Cai, 2008-04-11).

Summery of the internal factors' impact on the alternatives

Structure

- A hub set up in Beijing signifies largest structural changes for the suppliers, since they need to replenish two hubs instead of one.

Process

- The processes within the CPL operation will not change significantly. The information flow will increase some, providing the suppliers with a better insight on where their material is being consumed.

Relationships

- The relationships in the supply chain might be affected if an additional hub would be set up in Beijing.

6.5.3 Total Cost Analysis

To be able to perform the total cost analysis we have had access to invoices, price lists and data from the enterprise resource planning system at Sony Ericsson. When calculating the costs we made one assumption, that all prices will increase with the inflation and will have the same relative impact in the future as now, hence we have used current prices. We have used Sony Ericsson's forecasted volumes for 2010 in all calculations. The forecasted volume as well as the calculations is highly confidential information for Sony Ericsson and therefore no actual figures will be presented.

The total cost analysis excel chart is presented below in table 6.9. The numbers presented are increased costs if nothing else is written. The calculations show that an increased capacity in Hong Kong would give a total increased cost of 37 percent compared to today's operation. A set up of a parallel hub would in total increase the costs by 84 percent.

Table 6.9: The total cost calculations; increased capacity in Hong Kong versus a parallel hub in Beijing.

	Alternative 1 - Increased capacity in Hong Kong	Alternative 2 - Parallel hub in Beijing
Transportation costs	44%	51%
Inbound freight	47%	146%
Outbond freight	40%	-86%
Warehousing costs	32%	100%
Order processing and information costs	0%	32%
Lot quantity costs	0%	0%
Inventory carrying costs	66%	201%
Place/Customer service costs	6%	24%
Total cost	37%	84%

Transportation costs

The transportation costs are divided into two types of costs; inbound and outbound freight costs. Inbound freight cost include all transportation costs from the supplier to the hub/hubs. Currently, the suppliers’ material is picked up from 28 different locations in Asia, Europe and North America and transported to the hub in Hong Kong. 55 percent of the volume is transported by flight to the hub in Hong Kong; the remaining 45 percent is picked up in Hong Kong and transported to the hub by truck. (Wong, 2008-04-14) Outbound freight cost include all transportation cost from the hub to the three factories in Beijing. Currently, all shipments from the hub in Hong Kong to the factories in Beijing are transported by flight. All transportation costs, both inbound and outbound, are financed by Sony Ericsson but managed by the third part logistics partner. (Au, 2008-03-19)

The transportation costs have been calculated by using an invoice for inbound shipments from an average month in 2007. We have extracted the volumes from the invoices and used the current shipment price list.

Alternative 1 – Increased capacity in Hong Kong

The inbound freight cost will increase almost proportionally with the increased volumes. With higher volumes the price per transported kilogram will decrease slightly, and therefore the freight cost is not directly consistent with the volume increase.

The outbound freight cost will increase slightly more than proportionally with the increased volumes. With an increased frequency of shipments to the Beijing factories, the volume per shipment will be almost the same as current even though the total volume will increase. Hence, the prices per transported kilogram will be approximately the same as today.

Alternative 2 – Parallel hub in Beijing

The inbound freight cost will increase with more than the double, due to more shipments and higher volumes. With two warehouses to replenish, the suppliers will have to send all material to two locations, Hong Kong and Beijing, i.e. a doubling of shipments. The volume per shipment will be less than today in most cases. Hence, the prices per transported kilogram will be slightly higher than today.

The outbound freight cost will diminish dramatically, since the freights from the Beijing hub to the factories in the Beijing area can be shipped by truck.

Warehousing costs

The warehousing costs include the costs Sony Ericsson pays the third part logistics partner for managing and operating the warehouse.

Alternative 1 – Increased capacity in Hong Kong

Increasing the capacity in Hong Kong will signify an expansion of the operation within the current facility, which is possible since there is still space to rent. In this way it is possible for Sony Ericsson to grow gradually and there is no need to use a whole new facility, until the capacity has increased more than what the current facility can handle. (Jarmander, 2008-03-20) To calculate the cost for adding space in the current facility, we got the figures for how much additional space cost to rent.

Alternative 2 – Parallel hub in Beijing

The Beijing hub would have the same capacity as the one in Hong Kong and hence, the warehousing costs will directly increase with a 100 percent even though the volume to Beijing would not increase all at once. This alternative will therefore have a higher cost per kilogram material in the hub. We received information about how much the current facility in Hong Kong cost and assumed a similar price for Beijing, since it is suppose to handle the same capacity.

Order processing and information costs

Order processing and information costs at Sony Ericsson include costs involving forecasts and data management, and the system that support the handling of orders.

These costs have been calculated by an average salary for a person working in the department, multiplied with the number of people needed (Hellsten, 2008-04-18).

Alternative 1 – Increased capacity in Hong Kong

The increased shipments to Beijing that alternative 1 suggests, will not imply any significant additional work and therefore no extra personnel is needed for handling the information.

Alternative 2 – Parallel hub in Beijing

With two hubs, there is a need for sending out two forecasts to the suppliers, one for each hub. The work with handling the increased information flow will demand an increased manpower in the Forecast & control and Data management group departments.

Lot quantity costs

Since the material is replenished continuously according to the forecast, it is hard to consider any lot quantity costs. Therefore, we will not regard this cost in the total cost analysis.

Inventory carrying costs

In a Vendor Managed Inventory warehouse, as in the CPL solution, the suppliers will carry the inventory cost. However, Sony Ericsson is responsible for ensuring that the material in the warehouse is consumed within agreed time frames; if not, Sony Ericsson is obliged to buy the material from the supplier. This means that Sony Ericsson owns inventory that has not been consumed within agreed time frames, and hence carry inventory cost. (Wong, 2008-03-20)

The inventory carrying costs have been calculated by using data from the enterprise resource planning system regarding the inventory carrying today. We have then in discussions with a business controller at Sony Ericsson and a manager at the third part logistics partner estimated how these costs would change.

Alternative 1 – Increased capacity in Hong Kong

The inventory carrying costs will increase more or less proportionally with the increased volume.

Alternative 2 – Parallel hub in Beijing

The inventory carrying costs will increase significant more than proportional with the increased volumes. When having two warehouses the total level of inventories will rise to avoid shortage at any of the warehouses. This implies greater inventory carrying costs for the suppliers as well as greater risks. When talking to one of the suppliers, we got the impression that they would try to shorten the time frame for owning the material in the warehouse when negotiating with Sony Ericsson regarding replenishing two warehouses instead of one. (Fayeulle, 2008-04-09) Taking this into account, there is a risk that Sony Ericsson's inventory carrying costs will increase dramatically.

Place/Customer service costs

Customer service costs at Sony Ericsson include the personnel at the CPL Operations department in Beijing that are handling all operational contact with the suppliers as well as with the factories.

The costs for this position were calculated by an average salary for a person working in the department, multiplied with the number of people needed. (Hellsten, 2008-04-18)

Alternative 1 – Increased capacity in Hong Kong

An increased capacity due to growth would gradually demand an enlarged manpower in the department for customer service, i.e. CPL Operations.

Alternative 2 – Parallel hub in Beijing

With two hubs, there would be more work with assisting the suppliers with replenishment and the factories with purchase orders. Also, it would demand more manpower to buy the material from the suppliers and sell it the factories since the work approximately would redouble.

Summery of the total cost analysis' impact on the alternatives

As can be viewed in table 6.9, the largest positions that would affect the two alternatives are the warehousing and the inventory carrying costs. A set up of a parallel hub would redouble the warehousing cost since the new hub would have the same capacity as the one in Hong Kong. The risk that Sony Ericsson would carry additional inventory costs would increase, due to the total increased inventory is placed in two warehouses.

6.6 Step 6: Select the Best Alternative

In this step the alternatives will be evaluated according to how well they measure up to the decision criteria set in step 3. This will be made having the conducted analyzes from step 5 in mind.

In step 3, the corporate strategy was viewed at from a supply chain perspective and since the supply chain objectives were aligned with the corporate strategy, three decision criteria were set:

- Increased *capacity*
- Shortened *lead times*
- *Cost efficient*

After having set the criteria and made the evaluation based on external, internal and total cost factors, we have, with the help of the decision criteria, investigated in which alternative we will recommend Sony Ericsson to choose.

6.6.1 Alternative 1 – Increased Capacity in Hong Kong

Increased capacity

The name we have given alternative 1, *Increased capacity in Hong Kong*, gives an indication to that the first criterion, *increased capacity* in the CPL solution, should be able to be met. It is in fact so, but only to a certain extent within today's facilities. Presently, the warehouse can handle an increased volume to meet the forecasted demand for 2010. If the volume exceeds this limit, Sony Ericsson will have to exchange the warehouse for a larger one. If Sony Ericsson would experience a large growth, either now or in the future, a new warehouse would be needed in order for them to be able to support the factories with material. The size of this problem is however hard for us to predict today.

Shortened lead times

With an increased frequency of shipments from Hong Kong to the factories in Beijing, shortened lead times in terms of time from a purchase order is sent by the factories to the time the material is delivered, can be fulfilled. This results in that the factories can hold a lower inventory stock on the material distributed by CPL. Also, managing the shipments via the airport customs, with generous opening hours, makes it possible to deliver material to the factories every day of the week.

Cost efficient

According to the total cost analysis made in step 5, the total cost will not be as high as for the second alternative. For this reason, the third criterion will according to us be fulfilled.

6.6.2 Alternative 2 – Parallel Hub in Beijing

Increased capacity

By a parallel hub set up in Beijing with the same capacity as the single hub in Hong Kong, the capacity in CPL would definitely increase, and hence the first criterion is fulfilled.

However when conducting the external analysis, we found that the mobile handset market is currently growing in markets where Sony Ericsson is not very strong. This indicates that a growth in this moment could be hard to accomplish. If Sony Ericsson does not grow in the same pace as they are expecting to, it can be hard to economically defend the large investment in capacity growth.

Shortened lead times

Positive aspects about a Beijing hub is that the material would be put geographically closer to the factories and in that way enable them, in theory, to pull material, i.e. collect, faster from the hub and hence, shortened lead times would be achieved.

The legal assessment showed that the solution in Beijing would not be possible with the trade laws existing in Beijing today though. Since the Bonded customs is only opened during office hours on Monday to Friday, the lead times could only be shortened during these days. Therefore, this criterion can not be totally achieved, leaving the factories to have inventory to be able to handle the weekend production.

Cost efficient

According to the total cost analysis made in step 5, the total cost of setting up a parallel hub in Beijing will be significantly higher than increasing the capacity in Hong Kong.

In addition to the criteria analyzes, the influences of the Chinese trade regulations, discovered in the external analysis, can be an obstacle for Sony Ericsson if deciding to set up a parallel hub in Beijing. Currently, the Chinese authorities do not approve of the set up that Sony Ericsson wants.

6.6.3 Making the Decision

The two analyzes demonstrate that the first alternative, increasing the capacity in Hong Kong and also, to increase the frequency of deliveries to Beijing fulfills all of the three criteria. This compared to the second alternative, setting up a parallel hub in Beijing, which only, in our analysis, fulfills one out of the three criteria. Hence, the conclusion that we draw is that Sony Ericsson should decide on alternative 1 in the current situation. Consequently, we think that today it is best for Sony Ericsson to wait with setting up a parallel hub in Beijing. It would probably be best for them to see how their sales will turn out in the future and also, wait and see how the Chinese trade laws might change and then perhaps take the decision to put up a hub in Beijing at a later moment.

7 Discussion

In this chapter a discussion with the aim of emphasizing the key findings that are the result of this study are presented. We will analyze the model's foundation and its modified content, coming from the theoretical framework presented in chapter 3, and how well it was applied to the case study. Finally, The Decisive Model will be evaluated against three of Wacker's key evaluation factors for created theories.

An important part of this study has been to provide the academia with a theoretical contribution. This has been done by combining theories from three fields: decision-making, strategy, and supply chain management. By combining these three theories we were able to create a model for strategic decision-making in supply chain.

From the field of *decision-making* we have used a rational decision-making model. The rational decision-making model was chosen for its structured nature and the ability to logically categorize all information needed when taking a decision. *Strategic* principles can help the decision-maker by narrowing the range of alternatives considered. Strategy also facilitates the decision process with a framework of analytical tools. *Supply chain management* theories have contributed with emphasizing on the importance of focusing beyond the firm's boundaries to include the impact of and on other supply chain members and predict their possible behavior. As well as highlighting the significance of having supply chain objectives in alignment with the corporate strategy to make an optimal contribution to the firm's business success. This theoretical framework was selected to fulfill the overall purpose of the thesis, namely; adjusting a structured rational decision-making model, making it applicable for strategic decision-making in supply chain.

7.1 The Rational Decision-Making Model as a Foundation

Our initial rationale for using the rational decision-making model was the model's inherent ability to logically structure and categorize information. However, while testing the model, certain shortcomings with the rational decision-making model became apparent. Although the content of the model and its steps are important and valid when making a decision, the decision process can not necessarily be conducted as chronologically as outlined. When we applied the model on our case at Sony Ericsson we were not able to follow the steps in order since new information that affected and changed the outlook of the problem constantly surfaced. It is hard to perform the steps in sequence when the premises of the problem are constantly changing due to the dynamic business environment. Ideally, to be able to follow the steps in the rational decision-making model the problem situation would need to be frozen, which is never the case in reality. For example, while conducting our case study, Sony Ericsson took the decision to set up a second warehouse in America in the purpose of supporting the Latin America production sites, which changed our problem premises. The model is however good for categorizing information although the sequence of the steps could be perceived as too rigid.

7.2 The Content of the Strategic Decision-Making Model in Supply Chain

In the first step of the model the decision-maker is suppose to define the desired as well as the existing state clearly, and give a complete description of the decision situation. This step is fruitful since it forces the decision-maker to clearly state the current situation and the desired situation, making the problem more clear and manageable. When conducting this step at Sony Ericsson we noticed that the problem is not always easily expressed and hence, this step fulfills a purpose.

In the second step of the model the decision-maker is suppose to identify concerned supply chain members and select a group of key persons representing all the different concerned stakeholders. At Sony Ericsson, this step helped the decision-maker to thoroughly think through which members of the supply chain, and departments within the organization, that would be affected by the decision. Identifying key people in the supply chain gave good results in that it enhanced communication. This led to a better understanding of the different parties' objectives in the supply chain and their different incentives. However, a gathered focus group might be even more desirable since it would give all the concerned parties a chance to communicate, thus improving understanding between them further.

In the third step the decision-maker identifies the decision-criteria and ensures that the supply chain objectives are aligned with the corporate strategy. Further, the supply chain objectives will be translated into criteria. Aligning the supply chain objectives with the corporate strategy facilitates setting up the decision criteria, which otherwise might be an overwhelming assignment without solid guidance. Sony Ericsson found the step very useful since it made them thoroughly think through their decision criteria and how to motivate that the coming decision will be in alignment with the supply chain objectives.

In the fourth step, alternatives that could succeed in resolving the problem are developed through brainstorm. Here, all alternatives that will not succeed in resolving the problem will be ruled out. In this step, we noticed the importance of trade laws and other regulations that a global supply chain is faced with. It might be desirable to further modify this step and include checking the alternatives with the country's legal authorities, before proceeding with the evaluation. It is unnecessary to waist time evaluating an alternative that can be ruled out just by considering the trade laws and regulations.

In the fifth step the decision-maker must critically analyze and evaluate the alternatives with the help of an analytical toolbox consisting of; macro-environmental analysis of the supply chain, strategic analysis of the supply chain, and total cost analysis. The fifth step includes a thorough analysis from a wide set of perspectives. Combining the framework of analytical tools from the strategic field with supply chain management, added value to the evaluation of the decision alternatives. To perform an external, internal, and cost analysis, gave the decision-maker a better

overview of what influences that affect the decision. Although, these forms of analysis are commonly used in the strategic field, Sony Ericsson still found that it gave them a new perspective on the decision situation.

In the sixth and final step, the decision-maker must evaluate each alternative against the decision criteria and then select the alternative that is most aligned with the criteria. By having set the decision criteria in step 3, knowing that the supply chain objectives were aligned with the corporate strategy, the decision-maker has ensured that the alternatives presented will be in the best interest of the firm. The criteria further makes it easier to stay focused on relevant and appropriate alternatives. In this step, it is possible that alternatives generated, although aligned with the criteria, might be ruled out. Even though an alternative might live up to the decision-makers criteria, internal, external and total cost analysis could show that the alternative is not feasible.

7.3 Analyzing The Decisive Model According to Wacker's Framework

The Decisive Model will be evaluated against Wacker's three key evaluation factors, explained in chapter 2.1.2, *Analyzing the decision model*.

7.3.1 Uniqueness

Two theories must be differentiated from each other, or else they should be considered a single theory (Wacker, 1998).

The Decisive Model's foundation, coming from the rational decision-making theory, is a traditional approach towards decision-making within economical theories and is in itself not unique. However, our contribution with theories from strategy and supply chain management is a new way to use the model. Therefore, the content of The Decisive Model can be considered unique, since no other rational decision-making model has, to our knowledge, been adjusted to strategic decision-making in supply chain.

7.3.2 Conservatism

A present theory can not be replaced by a new one, unless the new theory is superior to the present. Therefore, a present theory should not be rejected for the sake of change. (Wacker, 1998)

The Decisive Model can not be considered to be conservative since it does not rule out any other theories. The developed model can instead be seen as an attempt to begin to fill a theoretical void that we discovered in the search for useful decision-making models in the beginning of this study. Theory building is an iterative process that cycles through description to explanation, to testing and refining description and so forth. Therefore, our model can be seen as the starting point for such a cycle.

7.3.3 Generalizability

The more types of environments a theory can be applied to, the better theory it is and hence, the more it can be utilized (Wacker, 1998).

Our approach in developing The Decisive Model has been to make a general model for strategic decision-making in supply chain. However, The Decisive Model has only been tested on one case at Sony Ericsson. Therefore, the model needs to be tested on more cases in different environments, to be able to draw the conclusion of its generalizability.

8 Conclusions

In this chapter the major findings of this study will be presented. We will also return to the purpose and how it has been fulfilled. We will discuss the credibility of the study and at last, give recommendations for further study.

The purpose of this thesis was to adjust a structured rational decision-making model, making it applicable for strategic decision-making in supply chain. An underlying objective has been to test the model on a suitable case. Both the objective and the purpose of the thesis have been fulfilled; we have constructed a model and then applied it on a case at Sony Ericsson. The developed model, The Decisive Model, can be viewed in figure 8.1.

Step 1: Define the problem – the problem is a discrepancy between an existing and a desired state of affairs. In this step it is crucial to define the desired as well as the existing state clearly, to avoid ambiguity, and to give a complete description of the decision situation.

Step 2: Identify concerned supply chain members – map all the affected supply chain members and select a small group of key people representing all the different types of concerned stakeholders. The key people can then be consulted as a group or individually when evaluating the decision alternatives in step 5.

Step 3: Identify the strategic decision criteria – ensure that the supply chain objectives are aligned with the corporate strategy and set the decision criteria in accordance with the supply chain objectives.

Step 4: Develop the alternatives – generate possible alternatives that could succeed in resolving the problem.

Step 5: Evaluate the alternatives – critically analyze and evaluate the alternatives with the help of an analytical toolbox consisting of; external macro-environmental analysis, PESTEL, the strategic model of the supply chain, and the total cost analysis.

Step 6: Select the best alternative – evaluate each alternative against the criteria and select the alternative that is most aligned with the criteria.

Figure 8.1: The Decisive Model

8.1 General Conclusions

The rational decision-making model used as a foundation in our model contains appropriate steps for decision-making, however, there needs to be more flexibility in the sequences of the steps to accommodate for an ever-changing and complex business environment. To optimize the model, we believe that an alternative could be to not consider the steps as steps, but rather as categories. In this way, the information gathering could be conducted parallel instead of in sequence.

We consider that the content of the model is suitable for strategic decision-making in supply chain, and can therefore be seen as a good start in attempting to find a hands on guidance for managers faced with strategic decisions in supply chain.

In sum, the content that has been added to our model can be seen as a first step in theory-building in strategic decision-making in supply chain. Theory-building is an iterative process that cycles through description to explanation to testing to refining description and so forth. This study can be seen as the starting point for one such cycle.

8.2 Credibility of the Study

The developed model is supposed to facilitate a decision-maker faced with a strategic decision in supply chain. Hence, utilizing the theoretical framework consisting of decision-making, strategy and supply chain management when constituting The Decisive Model, ensures the reliability of the model.

Strategic supply chain focuses on developing; objectives and policies for supply chain management, the shape of supply chain in terms of facilities and locations and the outline of the organizational structure. In this study we have examined a case where Sony Ericsson faced a supply chain transformation decision regarding new facilities, which is considered a strategic change in supply chain. With the developed model, we were able to evaluate the decision situation and give Sony Ericsson recommendations. Therefore, we consider the internal validity of The Decisive Model to be high.

The approach in developing The Decisive Model has been to make a general model for strategic decision-making in supply chain. However, the Decisive Model has only been tested on one case at Sony Ericsson. We believe that the model needs to be tested on more cases in different contexts, to be able to confirm the model's external validity.

8.3 Recommendations for Further Study

To increase the external validity of The Decisive Model, we recommend that further case studies within different industries are conducted. It would also be of interest to test the Decisive Model on other variants of strategic decisions in supply chain.

Considering the different parts of the supply chain, we find it appropriate to take stakeholder theory into consideration in an attempt to further develop the model. Also, it would be a great task to deeper investigate in how international trade regulations can be added as a factor in the model. Finally as mentioned before, we think the model's foundation is slightly too rigid and hence, an attempt to make it more flexible would be positive.

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Bernstein, Barry, Manager, Information Management, Lund

Bian, Michael, Logistics Manager, Corporate Operations Supply China, Sony Ericsson, Beijing

Cai, Cathy, Purchasing Manager, Procurement, Sony Ericsson, Beijing

Cheng, Kenneth, Manager, IT Business South China, DB Schenker, Hong Kong

Fang, Angela, Senior Buyer CPL, Supply Chain Management, Beijing

Fayeulle, Fabrice, Customer Support and Operations Management, Texas Instrument, Beijing

Gran, Samuel, Business Manager 3PL, Business Management, Sony Ericsson, Kista

Hellsten, Per, Head of Supply Chain Management in Asia, Corporate Operations Supply China, Sony Ericsson, Beijing

Henriksson, Johan, Consultant, Sony Ericsson, Lund

Huiqi, Sun, Import Section Manager, Import/Export, Sony Ericsson, Beijing

Jarmander, Lars, Director, Logistics Innovation, Sony Ericsson, Beijing

Jober, Pontus, Head of Supply Chain Management in Asia, Corporate Operations Supply China, Sony Ericsson, Beijing

Li, Linda, MS Account Manager, Supply Chain Management, Sony Ericsson, Beijing

Linderg, Martin, Consultant, Sony Ericsson, Lund

Nordahl, Per, Analyst, Information Management, Sony Ericsson, Lund

Rijpma, Carl-Johan, Head of Long Term Planning, Supply Chain Operations, Sony Ericsson, Lund

Steen, Magnus, Director, Legal Support, Sony Ericsson, Lund

Svensson, Erik, Project Manager, Supply Chain Product Project, Sony Ericsson, Lund

Wong, Wendy, Senior Manager, Commercial & Key Account South China, DB Schenker, Hong Kong

Wu, Kason, Purchasing Manager, Supply Chain Management, Beijing

Xie, Andry, EL&AC Section Manager, Procurement, Sony Ericsson, Beijing

Xie, Zoe, Senior Manager, Customer Service & Quality South China, DB Schenker, Hong Kong

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